PHYSICAL SOCIETY EXHIBITION PREVIEW—*Pages 37-50*

LABORATORY PRACTICE

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VOL. 10 No. 1 | Published Monthly | JANUARY 1961

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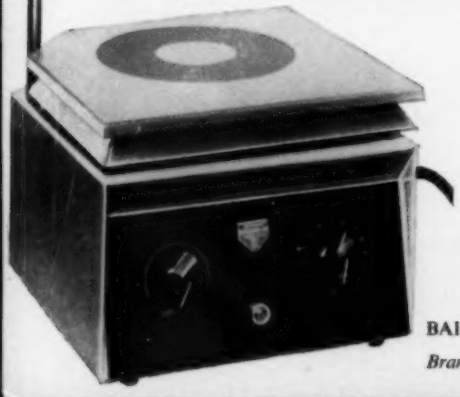

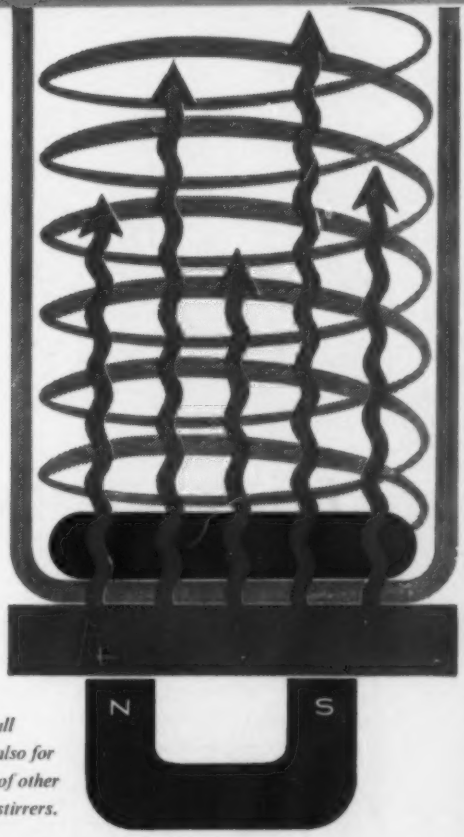

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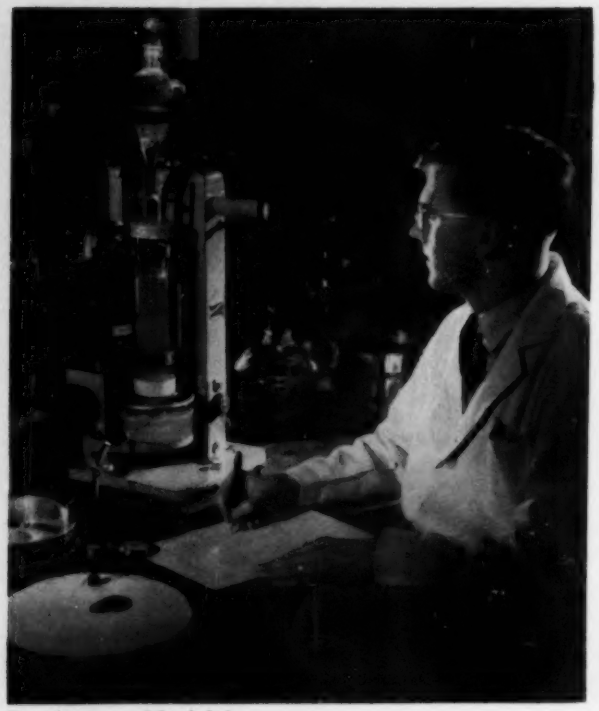
Particle Sizing by Sedimentation



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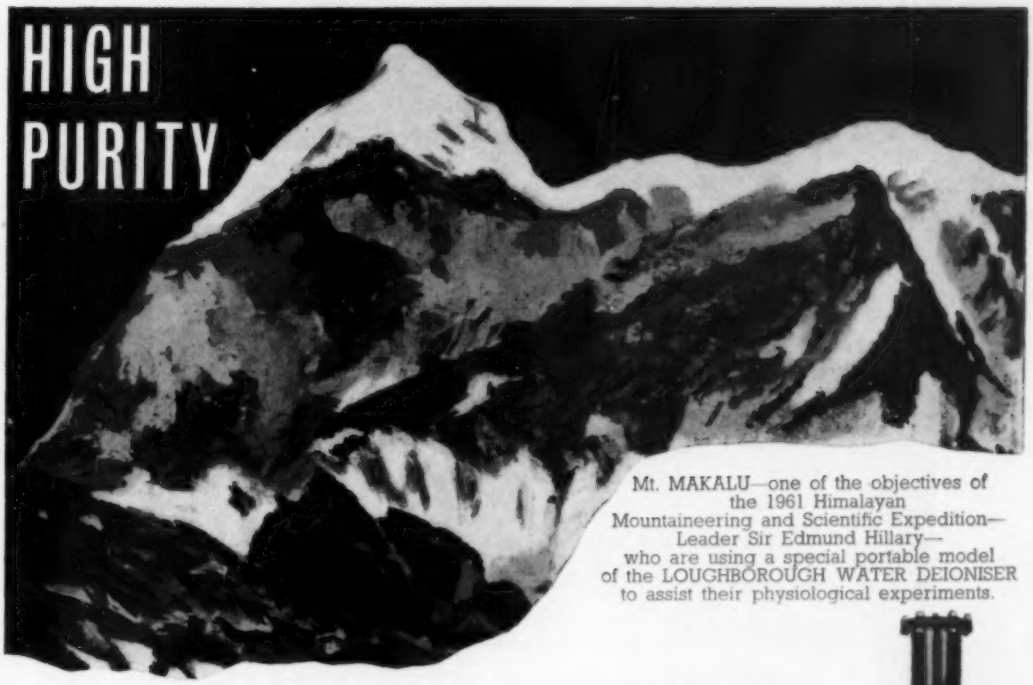

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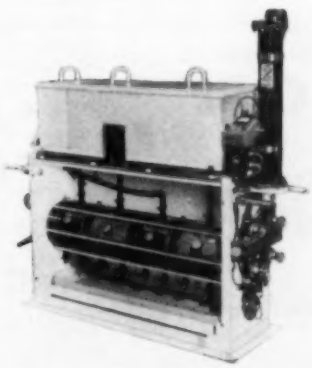

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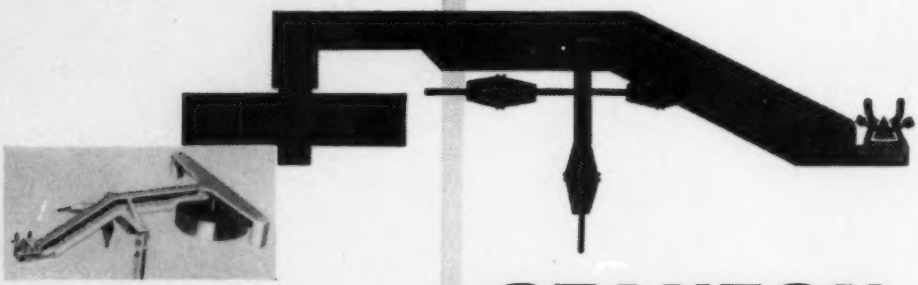

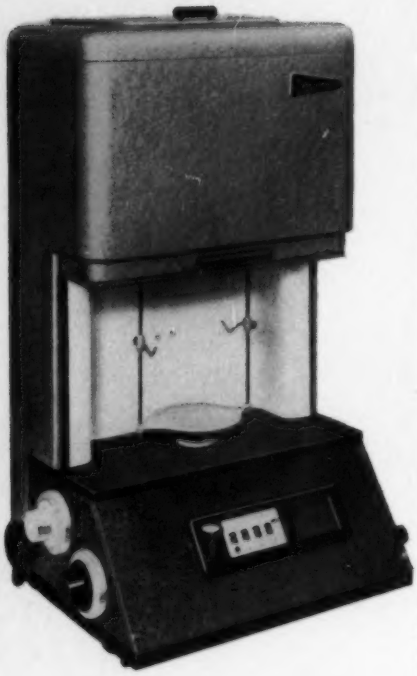

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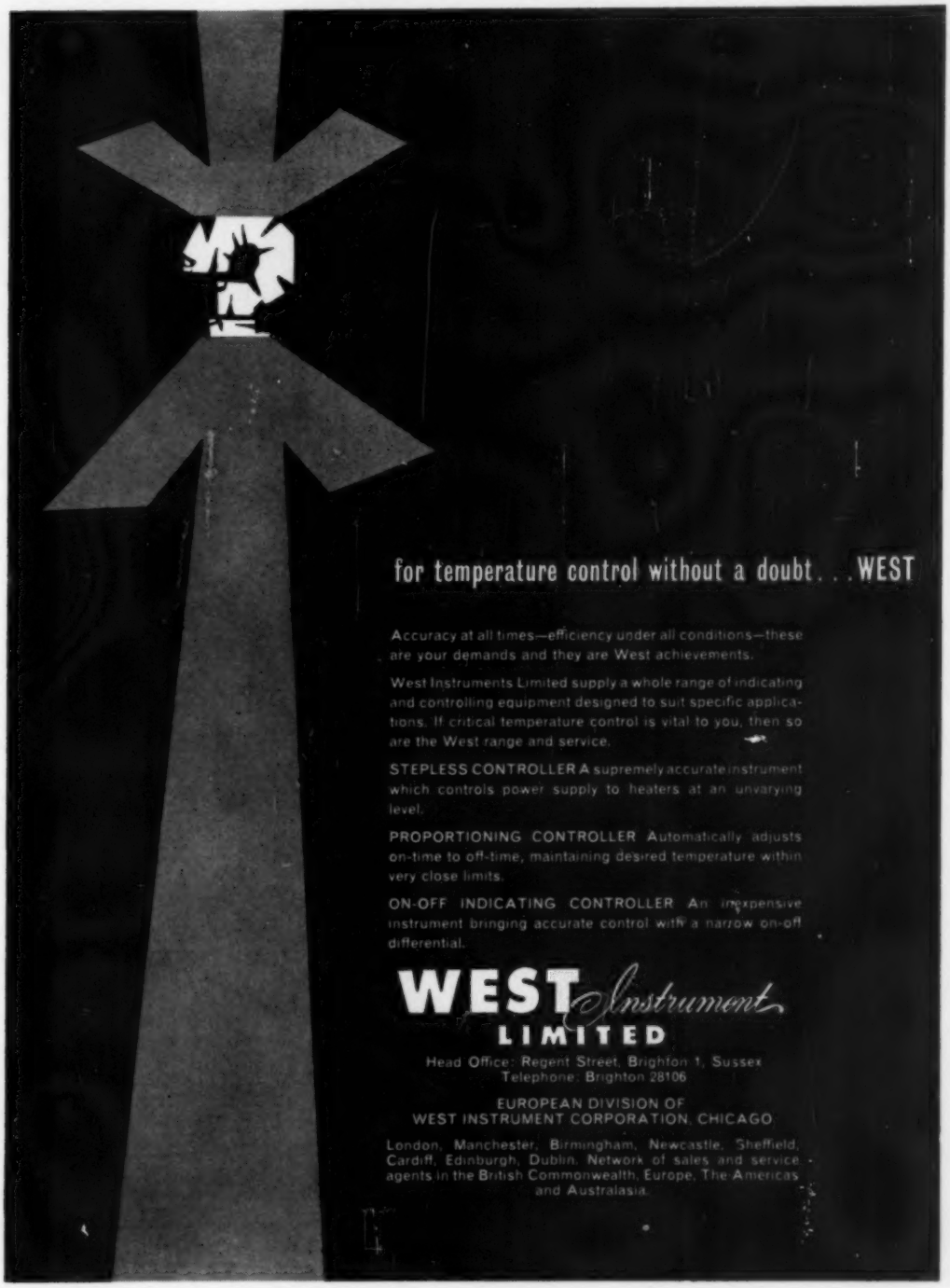
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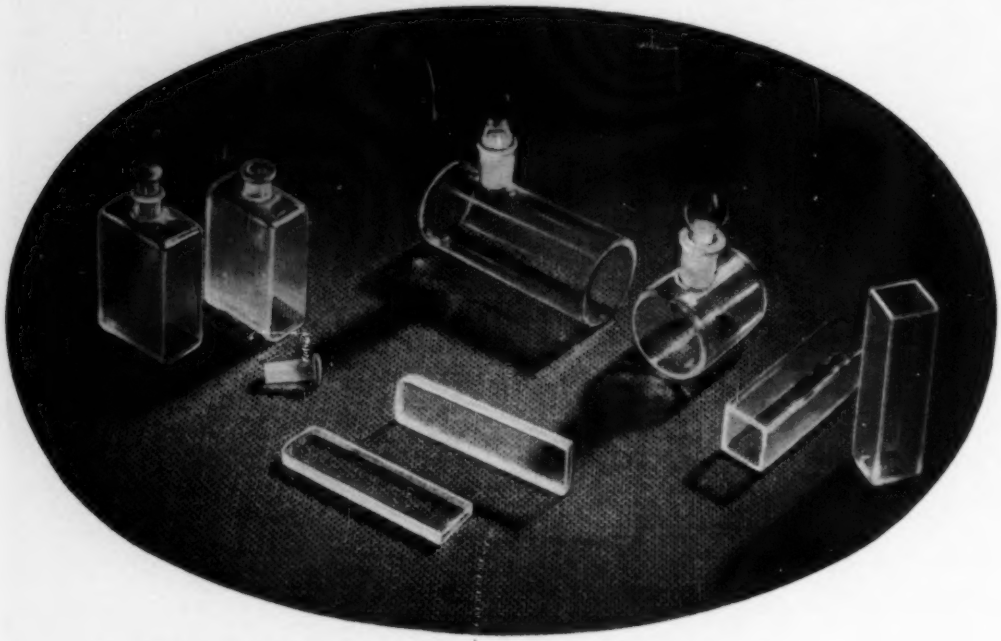

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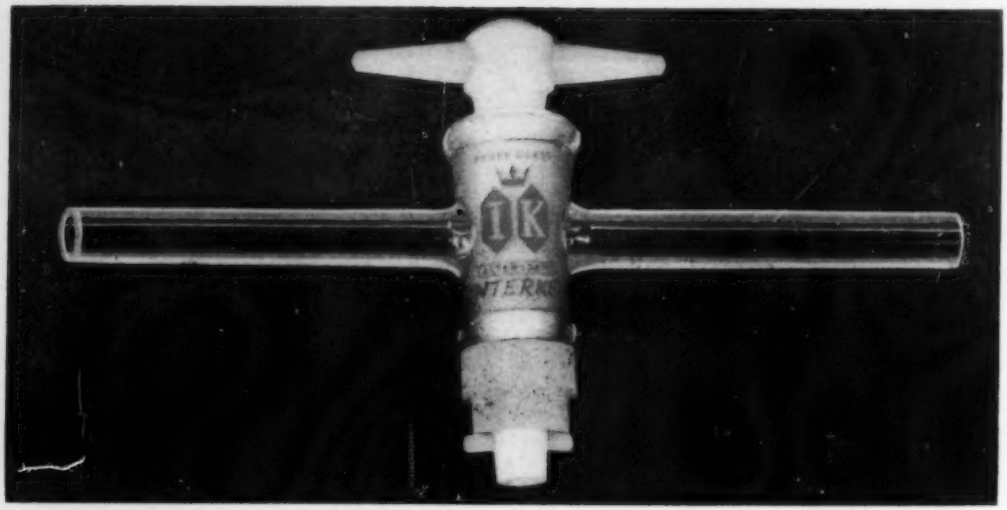

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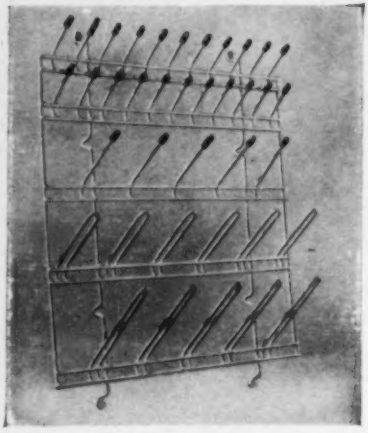

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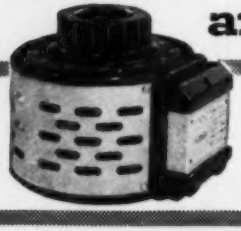

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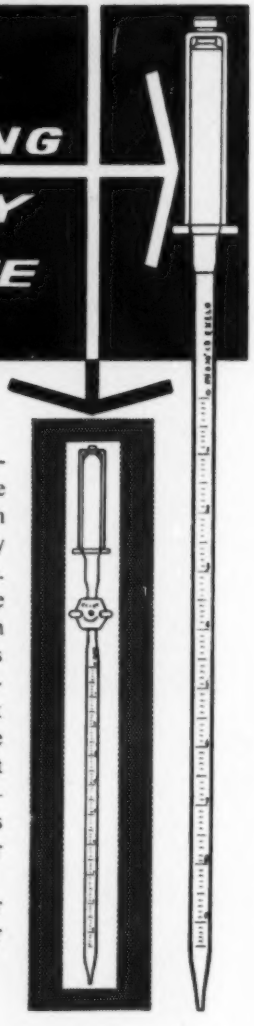

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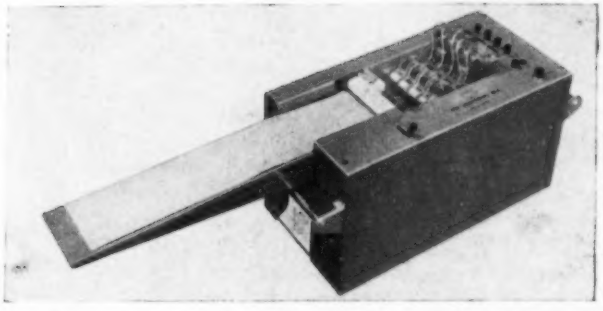

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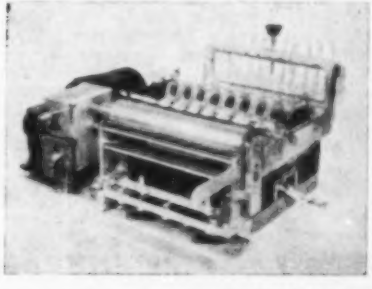

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[CRC 17/19

(BR PAT NO 645, 733,
US PAT NO 2, 655, 280)

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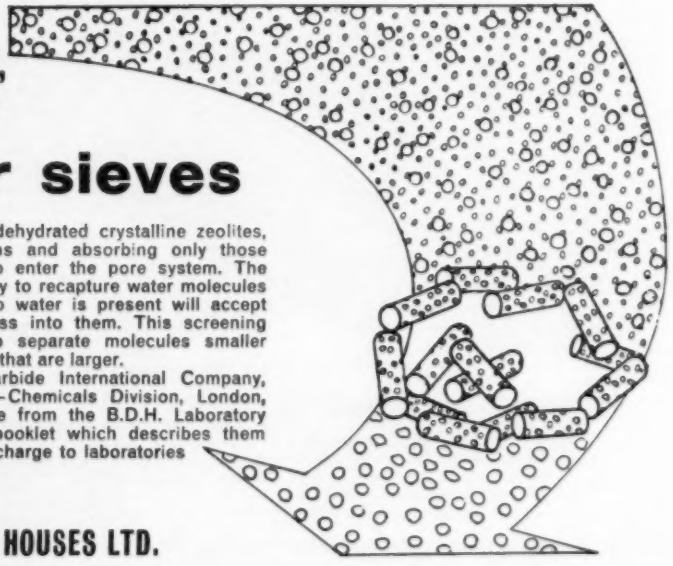

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EDITORIAL

Self Help in the Laboratory

BEFORE 1945, when the first atom bomb exploded and so made governments realize that science was worth spending money on, scientists, and especially research workers, frequently had great difficulty in getting money for apparatus. In those days many laboratories, even in famous places and doing first class work, often had a junk-shop appearance and much of the apparatus was home-made or a 'lash-up' of various bits. It was a recognized part of research training for the new graduate to settle down to constructing the apparatus for his work. The usual first task was to make a thermostat. The procedure was as well worn as the steps on a pilgrim's path. After procuring a biscuit tin, a retort stand and clamps, various items of Meccano and a small electric motor, one set about making a toluene-mercury regulator. Some considerable time would elapse before success in making one which did not break at the bulb-tube join as soon as it was set up. Altogether one or more weeks would be absorbed in this pastime. More elaborate apparatus might require anything up to a year. Today, with our increased interest in costings, we should be horrified at the idea of a graduate spending his time in this way. Obviously it is cheaper to buy such apparatus and accelerate the research.

Possibly this trend has gone too far the other way. Even if the union allows the research worker to mend a switch or use a hammer and chisel, he may not know how to do the job. Moreover labour costs have risen so much that maintenance and repairs are today costing nearly as much as the apparatus did before 1939. Apart from the cost of repairs, the delay in delivering new equipment makes it desirable for all laboratory workers not only to understand how their equipment works but also to be able to maintain it in an efficient working condition and to make at least the simpler repairs.

Most chemists and, of course, all physicists and engineers are capable of these requirements, but biologists, who are often shy of mathematics and have had no training in physics, are frequently completely at sea if any apparatus more complicated than an electric bell breaks down. The increasing complexity of

modern equipment does not encourage those with only an elementary knowledge of electricity to make any effort to understand it.

The old joke that the only instrument one can play is the gramophone is still true, but the modern gramophone with its many transducers, crossover networks, amplifiers, and so forth undoubtedly requires some skill and fundamental knowledge on the part of its player if it is to give of its best.

Likewise in the ever increasing application of electronics in laboratories, which may be called 'biological' as distinct from 'physical' and where electronic know-how is not generally available, we have often been astonished by the attempts of some of our biologically minded colleagues to rationalize some simple electrical problem, or equally intrigued by the respect shown by some competent biologists who categorically refuse to try and understand the workings of a small black box, and promptly 'send for the man who sold it' if it fails in its obscure function. Stories have been told to us by some of the service engineers who get called on these occasions about eminent men who have literally had to be guided, connection by connection, when setting up some modern laboratory aids such as nuclear counting equipment. In the world of motor car enthusiasts is a term called 'car sympathy' which distinguishes the good driver from the bad. To have it requires a little understanding about what goes on under the bonnet, and why one has to change gear occasionally. Modern laboratory apparatus is equally exacting; first one has to learn to drive it; it will then start to give results whether they be pH values or encephalograms. To drive it well, that is to get just that vital bit more information from it, requires an 'apparatus sympathy' which tells us *why* we work the apparatus in any particular way. With electronic apparatus the only way to get this apparatus sympathy is to open its bonnet and see how it works.

Unfortunately, once the bonnet is off in the literal sense only a more or less complicated and colourful array of valves, resistors, capacitors, etc. is to be seen. The secret to success in electronics is the understanding of the circuit diagram, without which even prolonged scrutiny of a piece of equipment is unlikely to yield useful information. Circuit diagrams can be frightening and they may appear extremely complicated, but once it is realized that they are made up of small easily identifiable sub-circuits each performing some well known function, the light will dawn and limitations, possibilities and faults of a piece of equipment, previously never dreamed of, will become obvious.

To help laboratory workers, and particularly biologists, we are publishing a series of articles on this subject. The series is intended primarily for those biologists and biological technicians to whom a working knowledge of electronics would be helpful. It in no way claims to be a complete electronics course and the fundamentals of magnetism and electricity are not considered. Instead the series has tried to convey, firstly an insight to the electronic way of thinking and an understanding of the terminology, and secondly a degree of practical competence which should enable the complete beginner to understand simple circuit diagrams, including the use of valves, and to design and make simple pieces of electronic equipment such as rectifier power units and simple amplifiers. This knowledge offers the reader a better understanding of the apparatus he may be using and should enable him intelligently to trace minor faults or carry out simple modifications.

The Harrison Memorial Prize 1959

At the meeting of the Harrison Memorial Prize Selection Committee held on December 7, 1960 it was decided that the Harrison Memorial Prize for 1959 should be awarded to Dr. Amyand David Buckingham in consideration of his research work in the field of physical chemistry and especially on account of his theoretical contributions to the understanding of solvent effects upon molecular spectra and to the theory of pressure-induced spectra.

Dr. Buckingham is a graduate of the University of Sydney, Australia. After a period of post-graduate research at Cambridge, he took up an appointment at Oxford, where he is now a Demonstrator and Lecturer in inorganic chemistry and a Student of Christ Church.

This Prize may be awarded for outstanding merit in any branch of Pure or Applied Chemistry. It was created in 1922 to commemorate the services of the late Colonel Edward Frank Harrison, formerly Deputy Controller of the Chemical Warfare Department, for the protection of the British Forces from poison gas in the 1914-1918 war. It is awarded to the British chemist, under 30 years of age, who, in the opinion of the Selection Committee, has during the previous five years conducted the most meritorious and promising original investigations in chemistry and published the results.

LABORATORY APPARATUS AND MATERIALS EXHIBITION

The second national Laboratory Apparatus and Materials Exhibition will be held in the Royal Horticultural Society's New Hall, Westminster, from June 19-22, 1961.

Sponsored by *Laboratory Practice*, the exhibition is being held so that manufacturers of apparatus, materials and other products specifically produced for laboratories can show their equipment to scientists and laboratory executives in industry, research, education, medicine and national and municipal government. It is expected that every possible type of laboratory requirement will be shown and demonstrated during the four-day exhibition. Both British and overseas equipment will be shown and many overseas buyers are expected to attend.

The first exhibition of this kind in the U.K. was held in London in June last and support was such that it is now to be a regular event. As last year, a series of lectures will also be given during the run of the Exhibition.

ARTICLES

ELECTRONICS FOR BIOLOGISTS

by G. C. Ware

Department of Bacteriology, University of Bristol

PART I

IN every laboratory and in nearly every experiment an electronic device of some kind is likely to be used. This series of articles is intended primarily to provide the completely electrically uninitiated person with sufficient practical knowledge to understand the apparatus he is using, without first asking him to master the fundamentals of magnetism and electricity. Almost no previous knowledge of electronics is required, and no mathematics beyond an occasional simple equation will be used. Inevitably therefore there will be a few omissions, many simplifications and possibly even an over-simplification.

Electric currents are flows of electrons and as these are negatively charged and are attracted to positive charges, that is electron vacuums, the convention that electric currents flow from positive to negative will be abandoned and all currents treated as flowing from more negative points in a circuit to more positive ones.

No progress is possible without an explanation of three terms:

1. *Voltage*.—This is measured in *volts*, millivolts (1 V. = 1,000 mV.) and kilovolts (1,000 V. = 1 kV.), and is the unit of electrical pressure difference existing between two points in a circuit without which an electric current would not flow.
2. *Current*.—This is measured in *amperes*, milliamperes (1,000 mA. = 1 A.) and microamperes (1,000 μA. = 1 mA.) and denotes the amount of electricity (number of electrons) flowing in the circuit.
3. Conductivity of the circuit is its ability to allow a current to flow but it is more usually expressed as resistance, or opposition, to the flow of a current. *Resistance* is measured in *ohms*, kilo-ohms (1,000 Ω = 1 kΩ) and megohms (1,000,000 Ω = 1 mΩ).

In practical electronics the volt is a unit of convenient size but the ampere is rather large and it is unusual to meet currents larger than a few hundred milliamps. In contrast the ohm is inconveniently small and kilo-ohms and megohms more often useful.

Fortunately these three properties of an electric circuit have a simple relationship. The current flowing between two points is in direct proportion to the voltage between them, and indirectly proportional to the resistance of the circuit. Ohm's law summarizes the relationship, where I is the current in amperes, E the voltage in volts and R the resistance in ohms, as:

$$I = \frac{E}{R}$$

One more concept is necessary, that of *power*, or electrical work done when a current is made to flow through a resistance by a voltage difference. Power is measured in *watts*, and can be calculated by the equations,

$$W. = EI \text{ or } W. = I^2R$$

(where E, I and R have the same meaning as in Ohm's law).

It is now possible to examine a simple practical problem:

A 2·5 V. torch bulb must be run from a 12 V. battery: calculate the resistance required to reduce the voltage. The circuit is shown in Fig. 1. In passing, note the symbol for battery, bulb and resistor and the circuit diagram arrangement where the base line, drawn in heavy type, is at zero volts and is usually earthed. The significance of earth varies in different applications. Primarily it forms a convenient common point in the circuit, such as the metal chassis of a radio set, and is usually regarded as being at zero voltage. It need not necessarily be connected to earth but this is often desirable.

The information printed on the bulb will reveal that it is designed for 2·5 V. operation and when this voltage is applied a current of 0·2 A. will pass. It is easy to calculate that the resistance and power of the bulb are

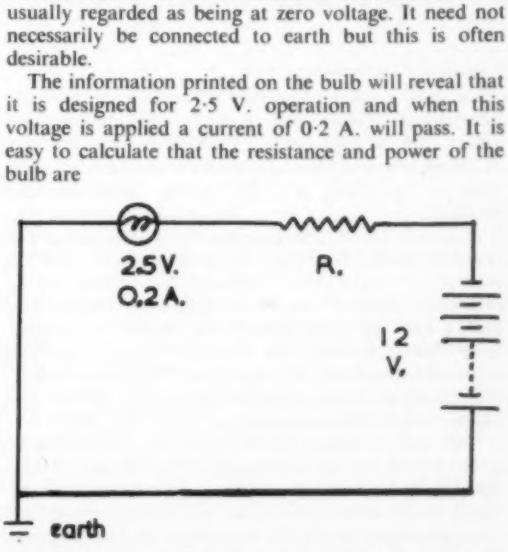


Fig. 1. A circuit for the operation of a 2·5 V. torch bulb from a 12 V. battery using a resistor to provide the necessary drop in voltage. The correct value for R is 47·5 Ω.

$$0{\cdot}2 = \frac{2{\cdot}5}{R}, \left(I = \frac{E}{R}\right), R = 12{\cdot}5\ \Omega$$

and

$$0{\cdot}2 \times 0{\cdot}2 \times 12{\cdot}5\ (W = I^2R),\ W = 0{\cdot}5\ W$$

respectively.

Since the battery voltage is 12 V. and the lamp requires 2·5 V. it will be necessary to drop 9·5 V. in the resistor R (Fig. 1.) When a current flows in a simple circuit its value is the same at all points so 0·2 A. will flow through the resistor as well as the lamp.

$$0{\cdot}2 = \frac{9{\cdot}5}{R}, \left(I = \frac{E}{R}\right), \therefore R = 47{\cdot}5\ \Omega$$

A 47·5 Ω resistor would therefore provide the required drop of 9·5 V. Alternatively we may consider the circuit as a whole. With a potential difference of 12 V. 0·2 A. will flow when the total resistance is 60 Ω, $\left(I = \frac{E}{R}\right)$, but the resistance of the bulb is 12·5 Ω (see above) therefore the resistance of the resistor R must be 47·5 Ω. In this example the internal resistance of the battery, through which the same current flows, has been neglected; as it is usually small this is permissible.

The resistance of the resistor having been determined, its power handling capacity must be examined. If a 47·5 Ω resistor with too small a power handling capacity was used it would overheat, too large a resistor would be more bulky and more costly than necessary. Since the resistor has a resistance of 47·5 Ω and a current of 0·2 A. flows through it the power loss in the resistor will be $0{\cdot}2 \times 0{\cdot}2 \times 47{\cdot}5$, $(W = I^2R)$, $\therefore W = 1.9$ W.

Commercial Resistors

The cost of a resistor is greatly affected by the accuracy to which it is made and in many applications exact values are unnecessary. Commercial resistors are therefore produced in various qualities with tolerances from ± 1 per cent to ± 20 per cent of the nominal resistance.

It is obviously meaningless to provide nominal values at intervals closer than the tolerance. This has led to the marketing of resistors of *preferred values* (Table I), where in each tolerance range the nominal values are separated sufficiently to be meaningful. Every value is available in several power handling capacities, the most common being ½ W, 1 W and 5 W. For the example, selection of a 47 Ω, 5 W. resistor with 10 per cent tolerance, should prove satisfactory.

Two main types of resistor are manufactured, *solid carbon* and *cracked carbon*. The former though cheaper is less stable over long periods of time and likely to produce, internally, minute random voltage changes resulting in *noise*. Noise may become apparent if these voltages are amplified. Wire wound resistors are also available up to about 100 KΩ. These are quiet, have good power handling capacity and stability, but

TABLE I

Preferred resistor values, in ohms, for resistors in the 5 per cent, 10 per cent and 20 per cent tolerances ranges. The values repeat in each decade up to a maximum of about × 10^6 Ω.

Tolerance		
20%	10%	5%
10	10, 12	10, 11, 12, 13
15	15, 18	15, 16, 18, 20
22	22, 27	22, 24, 27, 30
33	33, 29	33, 36, 43, 47
47	47, 56	51, 56, 62, 68
68	68, 82	75, 82, 91

× 10^1, 10^2 etc. to 10^6

are comparatively expensive. Solid carbon resistors are generally satisfactory except in the early stages of amplifiers.

Colour Code

Except in the case of wire wound resistors designed to work at high temperatures, resistors are labelled according to an international colour code (Table II) which indicates the resistance and sometimes also the tolerance. Power handling capacity is usually obvious from the size and is not often marked on the resistor.

TABLE II

International Colour Code for ohmic value of carbon resistors.

Black	= 0	Green	= 5
Brown	= 1	Blue	= 6
Red	= 2	Purple	= 7
Orange	= 3	Grey	= 8
Yellow	= 4	White	= 9

Fig. 2. Alternative methods of colour coding carbon resistors. (*a*) With significant body colour, (*b*) using three colour bands and attributing no significance to the body of the resistor. In both systems a = first digit, b = second digit, c = number of noughts after the second digit. *Examples.* (*a*) A red resistor with a green end and yellow spot would be 250,000 Ω. (*b*) Brown, black and blue bands working from the left of the figure would indicate 10 megohms.

Unfortunately, two systems of marking are in common use. In one (Fig. 2a) the colour of the resistor is significant and two further colours are added, one at one end and the other as a spot or band near the middle of the resistor. Alternatively the colour of the resistor is irrelevant and the value indicated by three colour bands. (Fig. 2b).

The body of the resistor or the band nearest an end indicates the first figure of the ohmic value, the end marking or the second band indicates the second figure while the centre dot or band in the first system or the third band with the alternative system indicates not a figure, but the number of noughts to be added after the first two digits. Where in the first type of marking a dot or end marking is apparently omitted it is the same colour as the body itself. Thus a resistor coloured uniformly orange would have a value of 33,000 Ω. Additional markings of gold and silver are sometimes used to indicate tolerance.

In electronics resistors have only one function, to cause a voltage drop in a circuit where a current is flowing. Such a voltage drop always appears as a voltage difference between the ends of the resistor. If in Fig. 3a the current in the circuit is 1 amp. then the voltage between

$$A\,B = IR_1\ V.$$
$$C\,D = IR_2\ V.$$
$$A\,D = I(R_1 + R_2)\ V.\ \textit{etc.}$$

As the resistance of the wire is almost zero, B and C are effectively at the same potential. Similarly D and E and the circuit could be simplified to Fig. 3b which shows a numerical example.

If it is necessary to control the brilliance of the lamp in the circuit described earlier (Fig. 1) this can be done by inserting a variable resistor, often called a potentiometer, in the circuit. Variable resistors are usually constructed to provide continuously variable resistance between zero and a nominal maximum value. The circuit (Fig. 4) should therefore contain two resistors, one fixed to give the correct maximum current for full brilliance when the variable resistor is set to zero ohms, in the example 47·5 Ω, and one variable, and of sufficient maximum resistance to reduce the light to extinction. Extinction is almost complete when the current flowing through a lamp is reduced to 50 per cent of its full brilliance value. In the example the current would have to be reduced to 0·1 A. and to achieve this the total resistance in the circuit must be

$$0{\cdot}1 = \frac{12}{R},\ \left(I = \frac{E}{R}\right),\ \therefore R = 120\ \Omega.$$

If the resistance of the lamp, and fixed resistance are 60 Ω as before, the variable resistor should have a maximum value of 60 Ω also.

Care is essential when the power handling capacity of a variable resistor is considered. When the whole resistance is in circuit and the lamp fully dimmed the power loss in the variable resistor will be 0·1 × 0·1 × 60, ($W = I^2R$) .·. W = 0·6 W, thus a 1 W. variable resistor appears adequate. However, the power handling

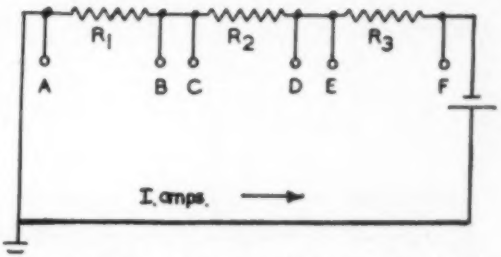


Fig. 3a. The current flowing in all parts of the circuit is the same. From Ohm's law, $I = \frac{E}{R}$, the voltage drop across each resistor is IR.

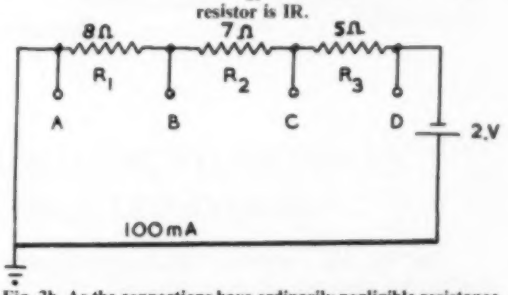


Fig. 3b. As the connections have ordinarily negligible resistance the circuit can be simplified. The figure shows a numerical example where the voltage between A and B would be 0·8 V; between BC 0·7 V; and between CD 0·5 V.

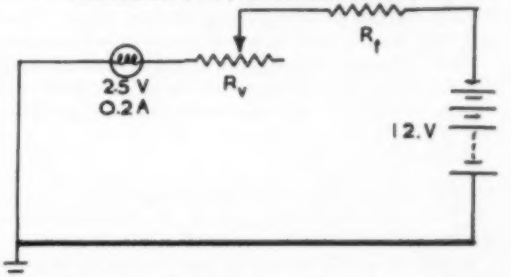


Fig. 4. The introduction of a variable resistor Rv enables the brightness of the light to be controlled. The fixed resistor Rf performs the same function as in Fig. 2 when Rv is adjusted to zero.

capacity of a resistor is a function of the maximum current which can flow through any part of it without causing over-heating and this maximum permissible current will be the same for the whole or any part of the resistor. When the brilliance of the lamp is almost maximum, the section of the variable resistor still in circuit will be carrying almost 0·2 amp. and a 60 Ω resistor capable of carrying this current would have a total power handling capacity of 0·2 × 0·2 × 60, ($W = I^2R$) .·. W = 2·4 W. and not 0·6 W. as originally suggested. Failure to observe this precaution is a common cause of potentiometer failure even in commercial equipment.

(To be continued)

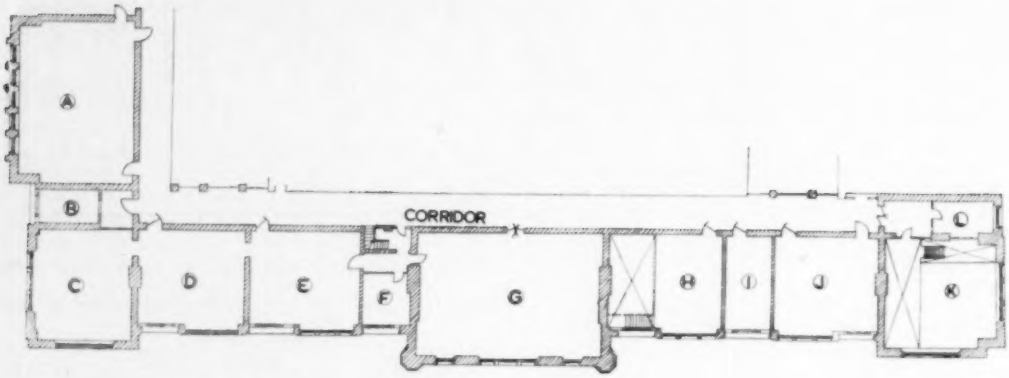


FIG. 1

CONVERSION OF OLD ACCOMMODATION INTO MODERN CHEMICAL LABORATORIES

by M. M. Crowder, M.Sc.Tech., and G. Holt, M.Sc.Tech., Ph.D., A.R.I.C.

This article describes the conversion of a series of top floor rooms of varying floor area and height to provide facilities for the teaching of chemistry to university students at undergraduate level. The layout of chemistry laboratories, store-room and balance room is discussed. This account deals only with part of a larger adaptation scheme carried out at the Manchester College of Science and Technology to accommodate an increased intake of students and larger numbers of teaching staff in the Department of Chemistry.

THE portion of the College concerned was built in 1902 and the plan of part of the fifth floor as it was prior to modification is shown in Fig. 1.

Rooms A and G were very high in relation to their floor area (A—31 ft. by 44 ft., height 40 ft., G—50 ft. by 33 ft., height 40 ft.). Room A was equipped as a model brewery and room G as a chemical engineering laboratory. The other larger rooms were used as laboratories and the smaller as offices for members of the teaching staff. All exterior and partition walls were of brick construction but flooring materials varied widely, e.g. wood block, wood strip, granolithic and asphalt. The rooms have vaulted roofs of timber and slate construction and false timber ceilings to give a void below the apex of the roof. Major alterations to the structure were undertaken to provide two large laboratories, by combining rooms H, I, J, K and C, D, E respectively. Room A was retained structurally unchanged to give a third laboratory. Rooms B and L provided office accommodation, G a lecture theatre and F, a store room/preparation room. Where necessary partition walls were removed to a height of 11 ft., leaving 3 ft. buttresses on either side of the room on which 16 in. by 6 in. R.S.J. beams were fixed to maintain the support of the roof. Where walls could not be removed completely, because they contained built in chimney stacks, openings of maximum size were made on both sides of the chimney breasts. Redundant doorways were blocked up and new ones cut at the appropriate places to a width sufficient for double doors to be hung. After carrying out the structural alterations the floor plan was then as shown in Fig. 2.

There were mezzanine floors in rooms K and H (Fig. 1). These were retained and in room H the mezzanine floor was partitioned off from the rest of the room from floor to ceiling, thus providing two smaller rooms. The lower room was converted to a balance room, the upper has now been equipped with racks and is used as a store room. Only wood block floors were retained and after installation of service channels, these floors were made good, sanded and finally sealed and wax finished. All other floor coverings were removed, and new levels created in screed to suit the laying of thermoplastic tiles.

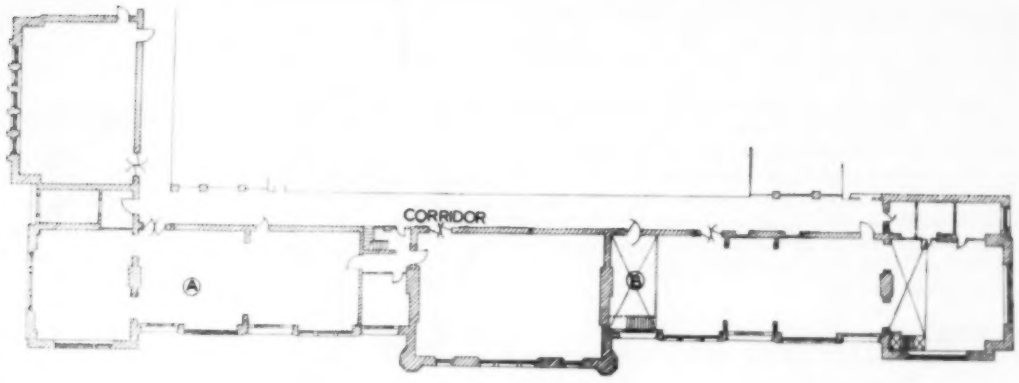


FIG 2

Laboratory Design and Equipment

It is proposed to deal in detail with only a part of the accommodation, namely that of one teaching laboratory (A, Fig. 2) and the balance room (B, Fig. 2). Other laboratories were furnished on a basis similar to A and the fittings, which are to be described, were used wherever possible. Standard items of furniture are again used in staff office/laboratories but the layout was modified to provide room for the obvious additional requirements such as a desk and book case. Whenever possible throughout the work of modification, standardized furniture units were employed.

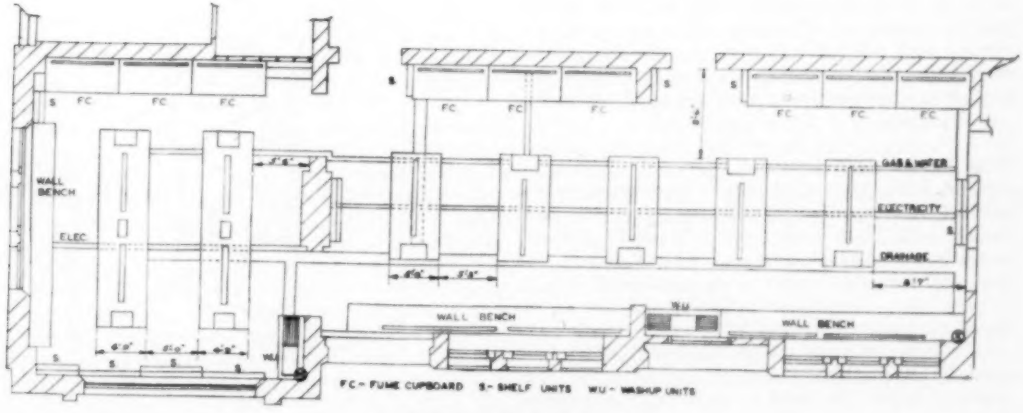
The question of how to accommodate the maximum number of students, each with an adequate working space, and at the same time provide reasonable space for special apparatus and also sufficient room for circulation, was one of the major problems at the design stage. The scheme finally arrived at is shown in Fig. 3 and the work has now been completed.

It will be appreciated that this design is not claimed to be an ideal, but is put forward to indicate how the available floor area has been utilized to what we feel is the best advantage.

Drainage and Services

Waste from lead-lined channels, drip-cups and sinks is collected by porcelain catchpits (12 in. by 12 in. by 12 in.), one per island bench, and where necessary on wall benches and fume cupboards. The waste discharges into a single underfloor channel of porcelain glazed fireclay (9 in. by 2 in. internal) which feeds into the main drain outlet stacks, *via* floor traps, at X and Y (Fig. 3). The floor channel is covered with $\frac{3}{16}$ in. mild steel chequer plate, the under-side of which is coated with bitumastic paint. One of the difficulties of the modification scheme lay in obtaining an adequate fall over the length of the channel due to floor construction (i.e. filler joists in breeze) which greatly

FIG. 3



restricted the depth to which the floor of the laboratory could be excavated. In this length the fall was extremely slight, but after one year's operation no difficulties from blockages have been encountered.

Other services in the laboratory were kept to the minimum consistent with efficiency, only a.c. power, hot and cold water and gas being installed. Each is fed to the benches and fume cupboards through floor channels. The electricity supply carried in steel trunking runs through all laboratories at a height of 10 ft. above floor level. Electrical power is fed to each laboratory through a distribution board and isolators to cater for all electrical services.

Lighting and Decorating

The suspension of lighting fittings by means of chains or tubes attached directly to the ceiling would have been unsightly because of the very high ceilings, and consequent long lengths of chain or tubing required. Therefore, light weight steel supports, fixed into the walls, were installed at the height of 9 ft. 6 in. above floor level (Uni-Strut) to which fluorescent fittings are directly attached. As far as possible the lighting fittings are at right angles to the benches thus reducing shadows to a minimum and providing good overall illumination rather than concentrated lighting of working surfaces. Lighting fittings consist of 5 ft. fluorescent tubes mounted in pairs inside a translucent Perspex diffuser. The Perspex diffuser was modified at our request so that the tubes are totally enclosed thus preventing access of dust, and as far as possible fumes. Further, the diffuser was constructed so that the 'reeding' is on the inside rather than on the outside, again for reasons of cleanliness. The colour is 'natural' and all tubes are colour matched.

The laboratory is decorated in a variety of pastel shades to provide light and pleasant surroundings without causing undue distraction. The ceiling colour (blue) was selected in an attempt apparently to reduce the lofty nature of the room.

The laboratory furniture was designed to be functional, pleasing and capable of being readily interchanged. All of the bench units were planned on a 3 ft. module and the number of different patterns was kept to a minimum. In all, five different patterns were used in the scheme. With the exception of the bench tops, oak was used throughout in the construction of the laboratory furnishing.

Bench Furniture and Services

Benches were constructed with a continuous Burma teak top (1⅛ in. nominal thickness) and lead-lined trough (4 in. by 4 in.—to give 3 in. bench opening) centrally placed beneath two-tier reagent shelves. The lead-lined trough is supported on iron stands fixed to the floor (or walls in the case of wall benches and fume cupboards) which also carry all other services.

Illustration of the two under-bench units which were specially designed are shown in Figs. 4 and 5. The standard locker unit used to accommodate students'

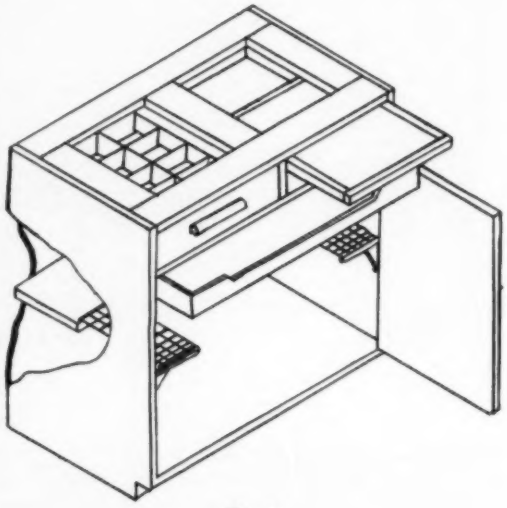


Fig. 4.

apparatus has a retractable writing flap, two small drawers, one of which is divided into various size compartments by a removable partitioning, an ample sized equipment storage space (33 in. by 24 in. by 19 in.) which contains a full width sliding shelf, 2½ in. deep for storing apparatus such as burettes, 'Quickfit' condensers, etc. The useful height inside the locker is made a maximum by reducing the conventional toe space to 2 in. The locker also has a 9 in. shelf at the rear upon which rests the rear edges of two polythene

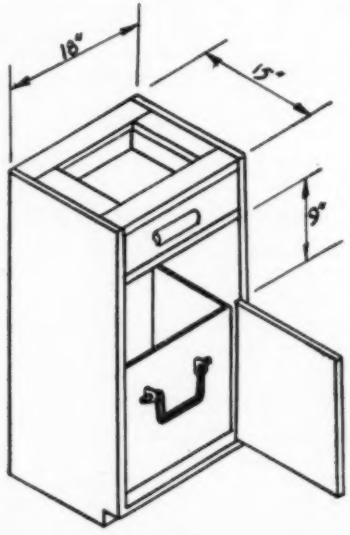
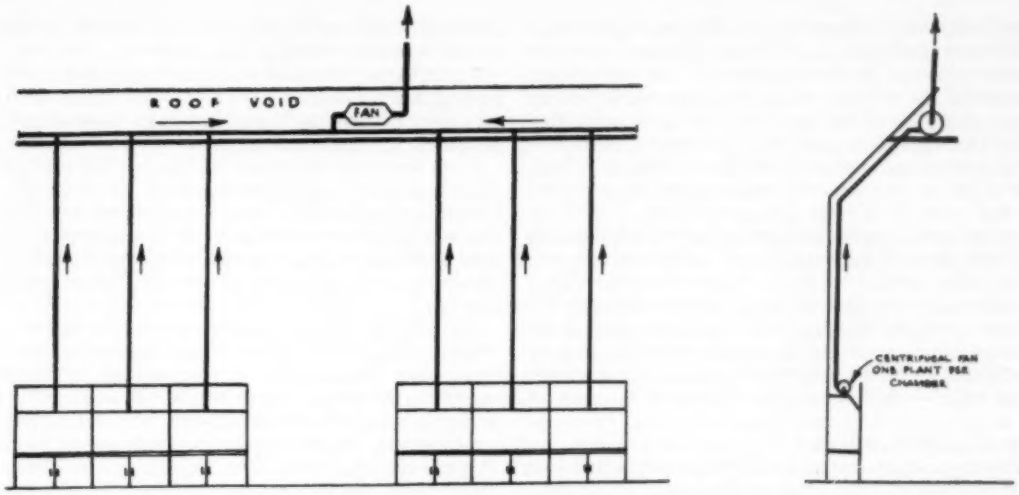


Fig. 5.



6 FUME CHAMBERS DISCHARGING TO ATMOSPHERE VIA PERMANENTLY VENTILATED ROOF DUCTING

Fig. 6.

coated storage racks, the forward edges being supported on cast aluminium brackets. Water pumps are connected to the main cold water supply and discharge through the bench top directly to a separate copper waste. All waste enters a receiver located at the bench ends (for island benches) standing directly over the porcelain drainage channel. The two small drawers may be secured by sliding wooden catches accessible only when the locker doors are opened, thus only one lock for each unit is required. The services per side for a short island bench (10 ft. 9 in. by 5 ft. by 3 ft.) comprise three two-way gas outlets, four vacuum pumps, four water taps, four 13 amp a.c. outlets; the latter are mounted in pairs between the reagent shelves and therefore remote from contact with liquids. Each short island bench has one sink (24 in. by 15 in. by 8 in. deep) with both hot and cold water taps and a 33 in. burette tap behind which stands a teak peg-board for apparatus drying. It will be seen from the plan (Fig. 3) that sinks are located at opposite ends of adjacent benches. In this way maximum working area is obtained and sinks are distributed as uniformly as possible around the laboratory. Side benches have similar under-bench units except that some cupboard and drawer units are replaced by drawer units, of conventional pattern, to provide increased storage facilities. Provision is made for general washing-up by the installation of larger sinks (30 in. by 18 in. by 10 in. deep) with peg-boards at the rear and double-sided draining boards. The conventional waste bins used were thought to be unsatisfactory and were replaced by the model shown in Fig. 5. The cupboard in which the painted steel bin stands is lined with asbestos sheet. Over the period which the unit has been in use no obvious damage has been caused to the entire unit. The two-tier bench reagent rack accommodates two rows of bottles per shelf separated by a central 1 in. wooden upstand. The shelves (13 in. and 24 in. above bench level respectively) are each 10 in. wide. The bottles themselves stand on sheets of vitrolite which rest freely on the wooden shelving.

General Purpose Reagent Shelves

Two types are in use. The first consists of a series of 5 in. shelves spaced 9 in. apart to a height of 6 ft. The second is a 'bookcase' type providing two shelves for Winchester quarts, then a wider shelf, followed by a series of 5 in. shelves; these 5 in. shelves commence at a sufficient height above the top wide shelf, so that a 'rough' laboratory balance can be accommodated.

Fume Cupboards and Fume Extraction

Fume cupboards are planned to a 7 ft. module and designed to have two opening sashes without a central dividing pillar. Lead counter-balance weights are attached to the sashes by polythene covered cord. The effective opening height is 2 ft. 6 in. and the internal working height is 5 ft. The working surface of the fume cupboards is finished with 4 in. Ruabon tiles set in a chemical resistant bond and at the rear is a lead-lined channel discharging through a lead waste into an individual receiver. The rear of the fume cupboard is constructed from hard asbestos board and finished with two coats of epoxy resin paint. The services per 7 ft. module consist of four a.c. outlets, four gas outlets, and four water outlets, mounted on the rear of the fume cupboard with front controls. The four a.c. outlets are mounted on the front facia board and

not inside the fume cupboard. All glazing is carried out with armoured plate glass. Internal illumination of the fume cupboard is provided by two 3 ft. strip lights mounted above glass panels, the glass panels forming part of the top of the chamber. Switches for the lights are also mounted on the front facia board. Each 7 ft. fume cupboard has an individual extraction plant, mounted in the enclosed space above the chamber which gives 24 to 30 air changes per hour. Fumes are carried away in asbestos ducting, running over the top of the series of fume cupboards as shown in Fig. 6. The main exhaust system is further equipped with a larger axial flow fan discharging to atmosphere. The space under the working area is enclosed by cupboard doors, which extend to floor level. Thus the cleaning of this space is facilitated by the absence of the wooden rail which is normally fitted at floor level.

Heating and Ventilation

Heating and ventilation in the laboratories is by means of the Plenum system and supplemented by unit space heaters, radiators were omitted as far as possible to free wall space.

Balance Room

The lower room B (in Fig. 3) was converted to a balance room by installing benches consisting of slate-slabs (1¼ in. thick), offset from the walls and mounted on substantial brick pillars; the latter are set on anti-vibration packing. The room was also fitted with ventilation fan, thermostatically controlled space heating, and a ring main system of 6 volts supplied to all balance positions from one main transformer. Individual balance transformers are not then required.

In an article of this type it will be appreciated that it is not possible to give complete details of all features of such a modification scheme. Nevertheless, we hope that enough has been written to indicate that even the most unfavourable accommodation can be adapted to provide good facilities for the teaching of practical chemistry.

The authors wish to record their indebtedness to Professor Haszeldine, Head of the Chemistry Department, who initiated the project and at all times stimulated progress, and to Mr. K. Bedward, Chief Engineer and Works Superintendent, who was directly responsible for all the work. The alterations to mains services, building work, floor finishes, painting, etc., were carried out by the College Works Department under the control of Mr. A. Clark, Assistant to the Chief Engineer, who prepared the necessary drawings and co-ordinated all trades and contractors.

The laboratory furniture was supplied and installed by Messrs. Cygnet Joinery of Bolton, who accepted our suggestions with tolerance and carried out their work with efficiency and success.

BOOK REVIEWS

An Introduction to the Anaesthesia of Laboratory Animals, by Phyllis G. Croft, PH.D., M.R.C.V.S. London: The Universities Federation for Animal Welfare. 1960. pp. 31. 3s. 6d.

A book on the methods of anaesthetizing laboratory animals is certain to be welcomed, because this apparently simple problem poses many technical questions. The present book has some 17 pages on equipment, handling of animals, choice and administration of drugs, pre- and post-operative and emergency measures, and a further seven on anaesthetizing five species—rabbit, guinea-pig, hamster, rat and mouse. It also has a small glossary, a selection of trade names for some anaesthetics, and a conversion table.

The author, a veterinary surgeon with considerable experience of small animal techniques, cannot therefore be accused of prolixity, and yet she has managed to cram a very useful amount of practical information into this slim volume. So much so, that one wishes it had not been so slim, but had included much more detailed information on the subject. It is to be hoped that this book will quickly sell out, as it deserves to, and that UFAW will persuade Dr. Croft to write a second edition on a more generous scale.

The book is intended to 'assist technicians and junior graduates to select and administer anaesthetics effectively and humanely'. Brevity is to be admired, but here it almost goes too far. On the other hand, the glossary is, in my opinion, superfluous; terms used in a book of this kind should not be above the heads of those who are regarded as competent to anaesthetize animals—almost by definition of competence. The list of trade name equivalents of BP barbiturates is curiously selective; only two are to be found in the 24th edition of Martindale, and one of these is incorrect. The reference to proprietary preparations in the text is also invidious. There is an index of 143 items, an ample allowance for some 20 pages of text.

But at the price this book is excellent value and should be in the hands of everyone who may have occasion to anaesthetize a small laboratory animal.—W. LANE-PETTER.

Gas Chromatography Abstracts 1958 and 1959. Compiled and edited by C. E. H. Knapman assisted by C. G. Scott. London: Butterworths Scientific Publications Ltd. 1960. 1958 volume: pp. 262 + vii. 42s. 1959 volume: 164 + ix. 42s.

The rate of growth of gas chromatography since 1952 has been so phenomenal that it is almost impossible to

keep up with the flood of papers. A number of institutes interested in the technique had by 1958 set up their own abstracting services. In 1958 the members of the Gas Chromatography Discussion Group suggested that it should publish such abstracts. The inaugural volume is a combination of bibliographies compiled by three members of the Abstracts sub-committee.

It covers all the literature from its inauguration in 1952 to 1958 and is to be kept up to date by further yearly volumes. Each volume is to contain a detailed index covering all aspects of the subject that allows any paper to be found quickly. This first and one hopes longest volume contains 1,468 references.

The second volume in the series covers the literature published during 1959. It maintains the high standard of the 1958 volume and even improves on it since a list is given of the journals abstracted (118 in all). Like the inaugural volume an author and a detailed subject index are provided. Any paper in which gas chromatography has been used is listed though it might be argued that in the future the abstractors might cast their nets less widely. Nevertheless, the editors and members of the Abstracting Service of the Gas Chromatography Group are to be thanked for making life so easy for workers in this field. Work on a similar scale in other fields would cut down the amount of reading required of scientists today.—A. T. JAMES.

Chemical and Natural Control of Pests, by E. R. de Ong. New York: Rheinhold Publishing Corp. London: Chapman & Hall Ltd. 1960. pp. 244 + viii. 60s.

Dr de Ong is already well known in the field of pest control for his earlier book on the chemistry and uses of pesticides. This is a companion volume in which a great amount of information is skilfully compressed and presented. One can imagine the author, a consultant entomologist, writing this book as a vade mecum to give him quick answers to the wide variety of problems presented to him. The coverage is entirely American and has the merit of being up to date but there is a noticeable superficiality in the treatment of some of the subjects.

The first chapter includes definitions and gives examples of pests and the losses they cause. The next three discuss insect predators and parasites and their fate in the face of modern chemical control methods; the diseases of insects; and pest-resistant plants. The remaining eight chapters deal with chemical control of pests and diseases, covering—chemicals as pesticides; the major field crops; orchards and vineyards; vegetables; ornamentals and lawns; animals; the household; and stored products. The references for each chapter are highly selective and mostly recent but there are many irritating inconsistencies between the lists and the text. The appendix of common and chemical names of pesticides is helpful.

This is a book mainly for reference and the index fails to offer the reader a satisfactory chance of finding many of the subjects referred to in the text. As examples, one can search in vain for bunt, cockroaches, chlorate European Red mite, horn flies, keds, clothes moths, powdery mildew, screwworms, smuts, and so forth. The 12 illustrations are excellent and the book would have gained by the inclusion of more. Those, in particular, who give advice on the pests and diseases of growing plants will doubtless want this volume in their libraries.—E. A. PARKIN.

Viscoelasticity: Phenomenological Aspects. Ed. J. T. Bergen. Acad. Press. New York and London, 1960. pp.150 + x. $6.

This book comprises seven papers read at a Conference held in Lancaster (Pa.) in April, 1958. The preface explains that by 'Phenomenological' is meant considerations which treat the material as a continuum, characterized by specific fundamental parameters, in contrast to theories involving molecular structures. In fact, several of the essays do discuss molecular structures, but the emphasis is on the former type of treatment. 'Viscoelasticity' is not so clearly defined but would appear to include also elastico-viscous behaviour, i.e. that involving flow.

Only two of the authors describe experimental methods directly; others test their theories against work already published elsewhere. The book is, therefore, hardly concerned with laboratory practice.

Attempts to extend classical theory to cover the complex behaviour of high-polymers, both within and without the range of linear super-position, naturally require advanced mathematics. There is a danger that such treatments may lead to 'mathematizing' for its own sake, without reference to real materials. On the whole, this danger has been avoided, except in a few places.

The style is sometimes difficult for the English reader: partly because of the use of words unfamiliar on this side of the Atlantic ('*The need . . . must, of course, not be de-emphasized . . .*'); and in some chapters, on account of needless obscurities of style. For example:

> '*The simplification in achieving a low-order model is simply that viscoelastic components having short-delay-time characteristics compared with the loading time to be treated will deform virtually completely throughout the time range of interest and can thus be lumped with the instantaneous elastic response*'.

The book is mainly concerned with materials which can be studied over very wide ranges of stress and many decades of time. The classical rheology of Maxwell and Kelvin bodies finds its place within much more restricted ranges. Only a few independent experimental methods are applicable to so wide a field and it is perhaps remarkable that super-position is at least sometimes possible and that there can be correspondence between the results of the various experimental methods.

The book is valuable in correcting a tendency among some rheologists to regard the phenomenological approach as in some way inferior to molecular studies. Each has its own part to play in rheological theory.—G. W. SCOTT BLAIR.

NOTES ON THE PREPARATION OF SAMPLES OF FOODSTUFFS FOR ANALYSIS

by R. M. Johnson, B.Sc., A.R.I.C.

National College of Food Technology (formerly of Messrs. Crosse & Blackwell Ltd.)

and P. Lindley, B.Sc.

Messrs. Crosse & Blackwell Ltd.

THE careful preparation of a sample is an essential part of any analysis, and if this is not done, the results of the analysis may be meaningless.

These notes are intended to act as a *guide* to the method of approach to the preparation of a particular sample. Nevertheless, each sample must be treated according to its properties and the proposed analysis.

I. Dry Foods

1. *Powders, e.g. flour, baking powder, spices, ground roasted coffee, cocoa, sugar.*—Pass through a 20 mesh sieve, grinding if necessary and then mix thoroughly. The sample may be reduced in size by quartering. Spread the mixed sample uniformly on a sheet of glossy paper, and divide into four approximately equal parts by dividing lines at right angles through the centre of the powder. Bulk two opposite corners and reject the remainder. Continue this process until a sample of suitable size is obtained.

   When not required immediately, store each sample in an air-tight container, which must not be opened in extremes of humidity or temperature.
2. *Dried Vegetable Matter, e.g. beans, peas, lentils, cereals, gums.*—Grind the sample to pass through a 20 mesh sieve and treat as powders.
3. *Dried Herbs, e.g. mint, thyme, savoury, sage.*—Chop to pass through an 8 mesh sieve and store in an air-tight bottle, preferably with a screw cap. Before removing a portion for analysis, shake the bottle well.

II. Liquid Foods

1. *Beer.*—Before determination of alcohol or specific gravity, remove carbon dioxide by shaking in a large flask, maintaining the temperature at between 20-25°C. If necessary remove any suspended material by filtration.
2. *Fruit Squashes.*—Mix thoroughly before removing a portion for analysis. Ensure fruit particles are evenly distributed.
3. *Minerals.*—If carbon dioxide is present, remove by pouring sample back and forth in beakers.
4. *Milk.*—Milk MUST be mixed thoroughly before every determination, by continuous slow inversions of the bottle. Vigorous agitation must be avoided, as air bubbles may be incorporated. A perforated plunger may be used in a cylindrical container, e.g. prior to the hydrometer test.

III. Flesh Foods

Except in the case of canned goods, as large a sample as possible should be taken.

1. *Meat—fresh, cured or smoked.*—Separate portion required; mince and mix with a mortar and pestle, at least twice. Store sample in closed container at 0-10°C. If frozen, the sample must be allowed to thaw slowly, then treated as above.
2. *Meat—Canned.*—Mix entire contents of can as in 1.
3. *Sausages.*—Remove casing, quickly mince and mix in a mortar and pestle, at least twice. Speed is essential if sulphur dioxide is to be determined.
4. *Fresh Fish.*—Unless specifically required, remove inedible parts, chop and grind. For soft flesh a high speed blender may be used.
5. *Canned Fish.*—(a) Macerate entire contents of can, or (b) if in oil or brine, separate liquid and analyse separately. Macerate the solid portion.
6. *Dried, Smoked or Salt Fish.*—Cut up, mix, shred or grind to as near a homogeneous mixture as possible. Frequently it will be necessary to perform two or three determinations on different parts of the material.
7. *Shellfish.*—(a) Without shell: Separate edible part, wash in clean water and drain thoroughly. Macerate. (b) With shell: Wash oysters, clams or scallops in clean water and drain well. Shuck into a clean, dry container, grind and mix thoroughly. For other types, separate the edible part, wash in clean water and drain well. Macerate and mix thoroughly.

IV. Oily Foods

1. *Oils and Fats—including hydrogenated vegetable oils.*—Melt solid fats and filter hot. Filter oils that are not clear. Keep in a cool place, protected from light and air, to retard rancidity.
2. *Butter.*—Melt the sample slowly in a screw capped bottle and shake gently and continuously while cooling.
3. *Cream.*—If the cream has separated to any extent, mix thoroughly before taking a sample. A little ammonia may help if the sample is badly separated.
4. *Salad Cream or Mayonnaise.*—These are normally homogeneous, but stir thoroughly, not vigorously before removing a portion. If the stirring is too violent, the emulsion may break, when it becomes very difficult to obtain a representative portion.

V. Other Foods

1. *Chocolate.*—(a) Chill until hard and grate to a fine granular condition. Mix thoroughly and keep in a tightly stoppered bottle in a cool place. Or (b) Melt in a water bath at ca.50°C., stirring frequently. Remove portions by pipette.
2. *Cheeses.*—Owing to the uneven distribution of water, careful sampling is necessary. Finely divide the cheese by grating, press through a 20 mesh sieve and mix well.
3. *Syrups, Molasses and Similar Products.*—Dilute with water (up to 30 per cent by weight) and with the minimum of heat, warm and stir to dissolve all sugar. Aliquot parts of the solution may then be taken for analysis, correcting the results for the dilution.
4. *Jams, Marmalades, Fruit Jellies and Similar Products.*—Thoroughly comminute the product by chopping and mixing. If stones or pips are present, these must be separated and weighed, the remainder being analysed and the result corrected.
5. *Fruit, Fresh or Dried.*—Pulp or macerate in a high speed blender. Remove pips and weigh as in 4.
6. *Canned Fruit or Vegetables.*—If packed in a liquid, the entire pack may be macerated before analysis. It is often better to separate the solid by pouring the contents of the can on to a tared 8 mesh sieve, draining all the liquor from the fruit or vegetable. The two parts can then be examined separately and from the relative weights of solid and liquid, overall figures may be calculated if required.
7. *Bread.*—(a) Non-Fruit: Cut loaf or half loaf of bread into thin slices. Spread slices on the glossy paper and allow to dry in a warm room until sufficiently crisp and brittle to grind well in a mill. (Weigh before and after drying). Grind entire sample to pass through a 20 mesh sieve and mix well. Keep in an air-tight container. The sample may be reduced by quartering if desired (See I, 1). (b) Raisin Bread: Proceed as in (a) but comminute by passing twice through food chopper instead of grinding.
8. *Nuts.*—(*a*) In shell: Remove shell, keeping the skin or spermoderm unless specifically excluded. Chop and grind so as to include oil. (*b*) Meat only: Chop and grind to homogeneous mixture to include oil. (*c*) Paste or Butters: Mix thoroughly.
9. *Pickles.*—Unless vegetable weights required, macerate entire contents of pack in a high speed blender, diluting with an equal quantity of water if necessary.
10. *Soups.*—It is generally inadvisable to macerate soups, especially cream soups, with a high speed blender as this may cause separation. If garnish or any solid matter is present, force the sample through a fine mesh (say 20) and stir well. Do not allow the sample to stand before removing a portion for analysis.

CORRESPONDENCE

To the Editor,
Laboratory Practice.

DEAR SIR,—In a paper by J. S. Hetman published in *Laboratory Practice*, 1960, **9**, 565-567 and in Table III of that paper we noticed with surprise that a sample of beer apparently contained 8 ppm. copper. Table III makes no mention of concentration units but it appears from the text that these are ppm. In addition Table I clearly states that 2 ppm. is the recommended limit for copper in beverages. Thus Mr. Hetman's paper would appear to lead the reader to understand that the copper concentration in beer is dangerously high. In our experience this is not so. Copper concentrations above 1 ppm. in ales are uncommon* and 2 ppm. is a very high value which results in a turbid beer. We, therefore, feel that there has been a mistake somewhere in Mr. Hetman's work.

An instrument for use in a brewing laboratory would require at least a sensitivity of 0·1 ppm. and, therefore, the instrument under discussion would hardly seem suitable.

Yours faithfully,

N. S. CURTIS,
A. G. CLARK.

*Ref.: Andrews, J. K. and Stringer, W. J. (1953). J. Inst. Brew., 62, Table II Stouts.
Hudson, J. R. (1955). Ibid., 127, Table II Ales.

Research Laboratory,
Whitbread & Co. Ltd.,
*Chiswell Street, London, E.C.*1.

Mr. J. S. Hetman replies as follows:
I accept Messrs. Curtis and Clark's contention that the concentration of copper in the beer sample (which was of continental origin) was unusually high, and not typical of the British product.

On the question of sensitivity, determinations at the 0·1 ppm. level are readily possible (cf. the wine sample) with the cathode ray polarograph.

Demonstration Meeting

The Society for Analytical Chemistry will be holding an evening meeting (6 to 9 p.m.) at Chelsea College of Science and Technology, Manresa Road, London, S.W.3, on March 29, 1961, for the demonstration of simple pieces of laboratory equipment. It is hoped to attract contributions from laboratories engaged on physical, microchemical and biological as well as general methods of analysis, the emphasis being on items made in the laboratories rather than on commercially produced apparatus.

It is hoped that as many people as possible who have or know of items of interest—no matter how small—will get in touch with Dr. T. L. Parkinson, Product Research Division, Beecham Foods Ltd., Beecham House, Great West Road, Brentford, Middlesex, at an early date so that a provisional assessment of the bench requirements and services can be made. Exhibits will be welcomed both from members and from non-members.

X-RAY SPECTROGRAPHY OF PLANT MATERIAL

by P. B. Vose

Welsh Plant Breeding Station, University College of Wales, Aberystwyth

Introduction

The use of x-ray fluorescence spectrography as the preferred method of analysis in a recent biological investigation by Vose and Koontz (1960), draws attention to the most recent of the physical methods of analysis which have been applied to plant material.

The basic advantage of x-ray spectrography over the well-established emission spectrographic techniques is that the material is merely presented to the x-ray beam as a finely ground powder, and after irradiation remains unchanged and available for any chemical tests that may be required. Further advantages are that little preparation other than grinding the material is necessary and there is no risk of contamination arising from extraction reagents, buffers, electrodes, glassware, etc., as in the emission techniques. Additionally, concentration of the element is not usually required, and there is no need for great precision in taking aliquots for analysis. It seems likely, too, that when an x-ray spectrograph has been set up for any analysis it can be operated by less skilled assistance than is required for the emission instruments.

The principal disadvantage compared with the emission techniques is that a larger sample with a greater concentration of the element to be analysed is required, although the sample is still small compared with that required for a conventional chemical method. Also, at present the x-ray technique is not so versatile as the emission methods in the range of elements covered.

General Principles

The principles by which x-ray spectrography might be used for analysis have been known for a long time, and the use of the technique in chemical analysis was discussed by Eddy *et al.* (1929) and by von Hevesey (1932). More recent papers are those of Birks *et al.* (1954) and Kemp and Andermann (1956), while Hall (1959) has given a popular account.

To those familiar with x-ray crystallography, x-ray spectrography will have points of considerable similarity. The sample of material to be analysed is irradiated with a beam of x-rays and the fluorescent x-rays excited in the material fall upon a curved crystal of known grating constant, frequently lithium fluoride. They are then reflected into the detector, which may be either a Geiger or scintillation counter. The wavelength of the fluorescent x-rays is determined by the angular setting of the crystal and detector, and as the element present is known from the operational wavelength, its concentration can be determined by the intensity of the reflected x-rays. Recording may be carried out by a chart recorder when a continuous scan is made, or by conventional scalers when counts are made at fixed angles.

The present state of technical knowledge limits the range of elements which can be analysed. Use is made of the K and L radiation spectra, and their intensity varies according to the place of any particular element in the Periodic Table. Thus, the most sensitive and at present the most practicable group of elements suitable for x-ray spectrography lie between scandium (At. No. 21) and barium (56). Within this range the radiation of the K spectra can penetrate air at atmospheric pressure, and the middle elements of this series, e.g. zinc (30), strontium (38) and molybdenum (42) are ideal for the x-ray fluorescence technique. It is apparent that the biologically important element calcium (20) lies outside these limits, and to analyse for calcium it is necessary to introduce a vacuum or helium path, as the fluorescence intensity of elements 20 and below is reduced beneath practical values by passage through air. The lowest element it is practicable to analyse is magnesium (12), as below this number in the Periodic Table the K radiation is too soft for detection, even using helium or vacuum paths. Above barium (56) the K spectra have too high energies for measurement and the L series spectra must be used, with some loss of sensitivity.

Methods

In practice, quantitative analysis may be carried out by using standards of known composition to obtain a working curve, with which the unknown specimen may be compared. It is theoretically possible to count on the peak of an element, that is to measure the fluorescent line intensity at the correct wavelength for the element, as fixed by the angle at which the goniometer is set to receive the radiation from the sample. The count is recorded as the number of counts in a preset time, and knowing the number of counts given by a standard sample it is possible to convert this count to percentage composition. This simplified procedure is not desirable in practice, as there is usually 'other element' interference which influences the amount of scatter radiation and the size of the background count.

The procedure developed by the pioneers of this technique with plant material, C. S. Brandt and V. A. Lazar (1958) of Beltsville and adopted by P. R. Stout and L. D. Whittig (1958) of the University of California, is to use the line/scatter ratio, $\frac{F}{S}$, as the basic unit of calculation. The line/scatter ratio may be more completely defined as the ratio of the observed intensity of a given fluorescent line, F, to the intensity of the

scatter radiation, S, in a region free from lines. In this way it is possible to take account of the fluctuations in the background count that may occur with slight changes in the mains voltage, other chemical constituents of the sample, etc. In scanning a sample to select a known fluorescent line or peak for counting, it is desirable that the peak chosen should be fairly sharp, so that the angles selected for counting the scatter radiation intensity may be spaced reasonably close to the angle of the known fluorescent line.

The plant material is presented so that 1-2 sq. cm. of surface is exposed to the x-ray beam. The sample may simply be finely ground and contained in a sample holder so as to present an infinite thickness to the x-ray beam, or else may be compressed in the form of discs, the latter procedure being favoured by Stout (1958). The formation of compressed discs of the material has the advantage that it eliminates any possible variability due to surface irregularity, fineness of grinding or compaction. Further, it is possible to support the disc at the edges, thus lessening the possibility of background interference due to the backing of the sample holder. The main disadvantage of discs is the trouble of making them; weighing out the ground sample to obtain uniformity and compressing the material. When ground plant material is used without discing the choice of sample holder is important, as the material from which it is made must not contain any of the element under investigation. Brandt and Lazar (1958) used a holder with a backing of 0·00025 in. thick Mylar plastic film while stainless steel planchets were used by Vose and Koontz (1960) in an analysis for strontium. Either equal weights or equal volumes of plant material may be taken. In practice, equal volumes are sufficient to achieve uniformity, but fineness of grinding and the adoption of a standard technique of filling the sample holder and smoothing the surface is desirable.

The preparation of standard curves may be approached in a number of different ways: (1) by the chemical analysis of a sample or preferably a number of standards to obtain known values of the element under investigation, (2) by adding known amounts of the element to an organic matrix of, say, starch or mannitol, (3) by adding known amounts of the element to plant material of the type under investigation, either of known or unknown composition.

The first method, as used by Brandt and Lazar (1958), is satisfactory when it is possible to analyse for the required element by chemical means, but falls down when the element is difficult or impossible to determine chemically. The second technique is superficially attractive but is impractical, due to the difficulty of achieving a homogeneous sample when mixing an infinitely small aliquot into a relatively great bulk. A further difficulty in using standards of this type is that no account can be taken of 'other element' effects or the general composition of the sample. The third method, of adding known aliquots of the element to plant material of the same type as that being fluoresced,

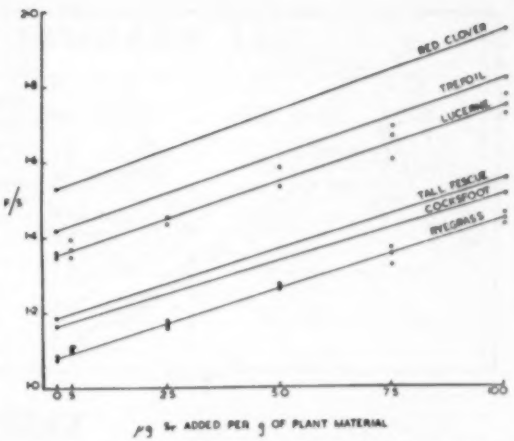


Fig. 1. The ratio of the strontium Kα (first order) radiation intensity to the scatter radiation intensity as a function of added amounts of strontium to dried, ground plant material of six species. (Redrawn from *Hilgardia*, 29, 575, 1960.)

enables a standard curve to be plotted by extrapolation, without the need for chemical analysis of the unknowns. This technique has been used by Vose and Koontz (1960) for strontium where chemical analysis is virtually impossible, and by Whittig and Buchanan (1958) for zinc, where chemical analysis is unsatisfactory.

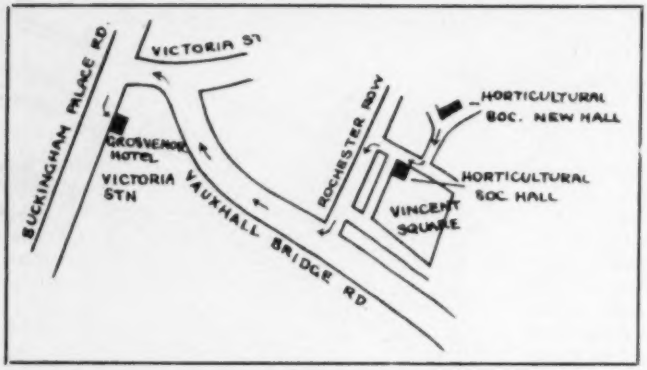
The technique adopted by Vose and Koontz (1960) was thoroughly to moisten the dry plant material with acetone and add the required strontium aliquot from a pipette, followed by complete mixing and stirring. The paste was then placed on a steam bath until the acetone had been driven off, followed by drying in the oven at 70°C. Mixing was carried out at every stage and the dry material was crushed to powder with a pestle. Separate subsamples of standards produced by this method showed good reproducibility. When the

$$\frac{F}{S}$$

line/scatter ratio, –, of a number of standards based on the same plant material was plotted a straight line resulted, which could be extrapolated to obtain the strontium content of the original plant material. This is shown in Fig. 1, and it can be seen that standards based on different plant species do not give superimposed lines, but parallel lines. It is thus possible to calculate a constant factor to enable the determination of the strontium content of any plant material. In the present case the mean increase in $\frac{F}{S}$ ratio per 100 μg of added strontium for various plant materials was 0·383 F/S units,

therefore, 1 μg Sr = 0·00383 F/S units
and 1 μeq Sr = 0·168 F/S units

(*Concluded on page 36*)



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P. 5980

APPARATUS AND DEVICES

A SIMPLE APPARATUS FOR INVESTIGATING THE ANTICONVULSANT ACTIVITY OF SOME DRUGS

by R. T. Brittain, B. Pharm., M.I.Biol.

Research Division, Allen & Hanburys Limited, Ware, Herts.

THE anticonvulsant activity of a drug can be assessed by the way in which it prevents convulsions and death induced by either strychnine (Berger, 1947) or leptazol (Yule Bogue and Carrington, 1953; Cahen, Groskinsky and Parisek, 1956) in small animals. It is often convenient to supplement visual observation, which can be tedious and lengthy with an automatic apparatus. In the course of an investigation into the anticonvulsant properties of some drugs in mice, a simple rubber tambour recording apparatus has been designed.

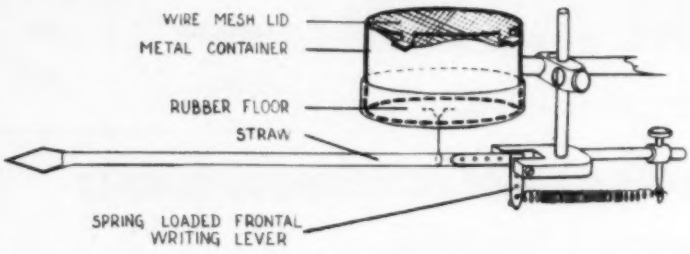

Fig. 1.

The apparatus (Fig. 1) consists of a circular metal container of diameter 7·5 cm. and depth 4 cm. with a thin rubber floor of dental dam, secured and held taut by Sellotape. On the undersurface of the rubber floor a thread is connected from an attached Sellotape loop to a spring loaded frontal writing lever. Normal and abnormal movements of the animal in the container are recorded on a smoked drum. The lid is of fine mesh wire hooked into position over four small metal projections bent outwards from the side of the metal container.

In the experiment briefly described here, mephenesin was examined for its anticonvulsant activity in protecting mice against the convulsive and lethal effects of strychnine. Mephenesin was administered in a range of doses simultaneously with a lethal dose of strychnine 1.6 mg./kg. Both drugs were injected intraperitoneally.

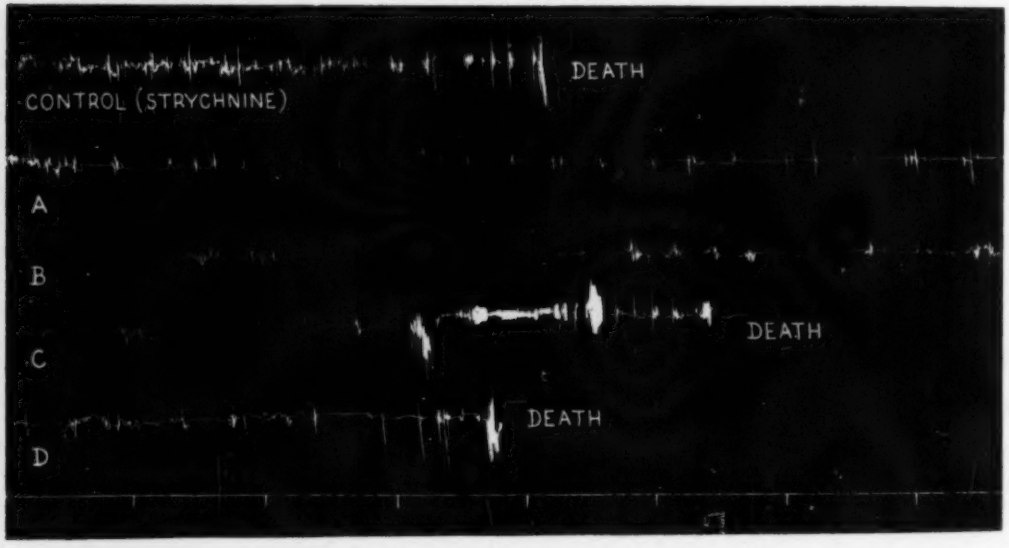

Fig. 2. Anticonvulsant activity of mephenesin against strychnine induced convulsions and death in mice. *Upper trace:* **Control strychnine 1·6 mg./kg. I.P.** *Traces A, B, C and D:* **Mephenesin administered I.P. at respectively 100, 75, 50 and 25 mg./kg. simultaneously with strychnine 1·6 mg./kg. I.P.** *Lower trace:* **Time, min.**

The results of this experiment, illustrated in Fig. 2, show that the minimal dose of mephenesin to protect mice against the convulsive and lethal effects of strychnine was 75 mg./kg.

Using small numbers of mice, the apparatus has been found to effectively record the anticonvulsant pattern of drug activity against both strychnine and leptazol. The apparatus is sensitive, cheap, simple to use, and can easily be reproduced for experiments involving increased numbers of animals.

I would like to thank the Directors of Allen and Hanburys Limited and Dr. P. F. D'Arcy, Head of the Pharmacology Department, for permission to publish this communication, and Mr. D. Rowe for technical assistance.

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A LABORATORY DEVICE FOR THE DILUTION OF VISCOUS LIQUIDS

by C. J. Lloyd

Pest Infestation Laboratory, Agricultural Research Council

Introduction

When small quantities of viscous concentrates have to be diluted, it is usually impossible to measure them volumetrically because of difficulties of drainage. Moreover, if the concentrate is darkly coloured, the meniscus may be obscured. In the course of experimental work requiring the frequent preparation of small quantities of dilute solutions of pyrethrins (an insecticide) in a technical white oil, a simple apparatus has been devised so that weighed amounts of liquid concentrate ($\eta \approx 58$ cP at 20° C.) can be washed into a graduated cylinder with diluent oil ($\eta = 29$ cP at 20° C.), and made up to the required volume. This note is published because the idea may have much wider application in the manipulation of somewhat viscous liquids.

Apparatus and Method

The insecticide concentrate is weighed into a special vessel (Fig. 1, A) made from a conical glass funnel 2 in. in diameter, with the stem reduced in length to $\frac{3}{8}$ in. The funnel has a tubular glass stopper (B), ground to fit into the stem and long enough to project above the rim of the funnel. When the concentrate is being weighed into it, the funnel is supported on the balance in a wire stand.

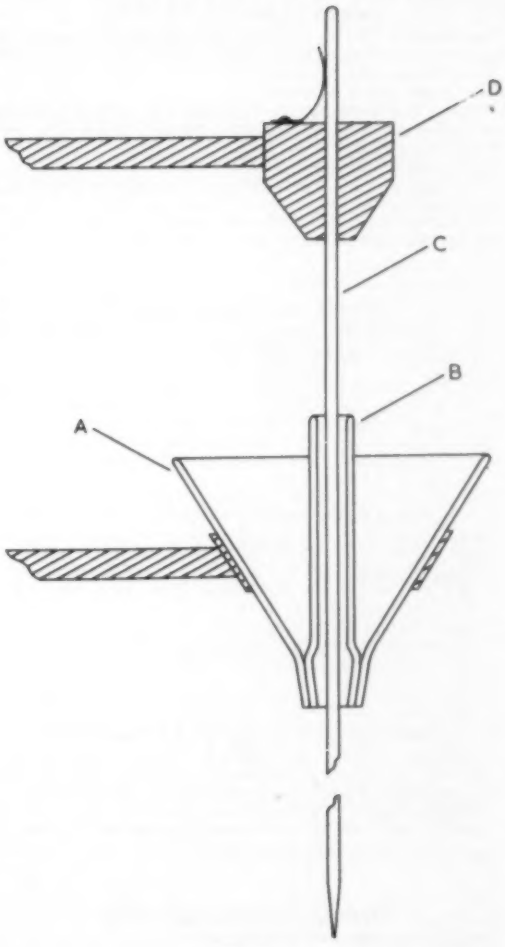

Fig. 1.

After weighing out the concentrate, the vessel is transferred to a holder mounted on a modified retort stand; the latter (not shown in Fig. 1) is fitted with levelling screws and has the upper surface of its base machined flat. A glass rod (C), supported by a metal block (D), is passed through the stopper into the graduated cylinder in which the diluted solution is to be received. A leaf spring on the metal block holds the rod at any desired height.

The tubular stopper is lifted slightly up the glass rod: most of the concentrate then runs down the rod into the graduated cylinder and the remainder is washed down with the oil solvent. As the liquid level in the cylinder rises the glass rod is slowly retracted; its tip is kept close enough to the surface to prevent falling drops causing air bubbles in the body of solution or round the meniscus.

Award of Royal Medals

Her Majesty The Queen has been graciously pleased to approve recommendations made by the Council of the Royal Society for the award of the two Royal Medals for the current year as follows:

To Sir Roy Cameron, F.R.S., professor of morbid anatomy at University College Hospital Medical School in the University of London, for his distinguished contributions in the field of cellular pathology.

To Prof. A. B. C. Lovell, O.B.E., F.R.S., professor of radio astronomy in the University of Manchester and director of the Nuffield radio astronomy laboratories, Jodrell Bank, for his distinguished contributions to radio astronomy.

Awards and Appointments

The Council of The Institute of Physics and The Physical Society which recently amalgamated has made the following Awards:

The Duddell Medal to Dr. J. B. Adams, the Director-General of C.E.R.N. (the European Organization for Nuclear Research), for his leadership of that team.

The Charles Vernon Boys Prize to Prof. A. W. Merrison of the University of Liverpool for his distinguished research in experimental physics.

The Charles Chree Medal and Prize to Dr. S. E. Forbush of The Carnegie Institution of Washington for his distinguished work on cosmic radiation.

The Council has also made the following appointments:

Guthrie Lecturer: Dr. D. Shoenberg of the Royal Society Mond Laboratory, Cambridge, has been appointed Guthrie lecturer for 1961.

Thomas Young Orator: Dr. H. H. Hopkins of the Imperial College of Science and Technology has been appointed to deliver the Thomas Young Oration in 1961.

Rutherford Memorial Appointment

Under the terms of the scheme to commemorate the late Lord Rutherford of Nelson the Council of the Royal Society has appointed Mr. W. J. Darcey, B.Sc., of the University of Melbourne, to the Rutherford Scholar for 1960 for three years, to carry out research in experimental nuclear physics at the Clarendon Laboratory, Oxford.

Recent British Standards

Density Hydrometers for Use in Milk

The publication of Part 1: 'Apparatus', of B.S.734 (price 6s.) completes the revision of this British Standard. (The revised edition of Part 2: 'Methods', was recently published.)

An important innovation in the revised edition of Part 1 is that hydrometers are calibrated to be read at the top of the milk meniscus and not at the level of the milk surface. Hydrometers conforming to this specification will be identifiable by a 3-5 mm. wide red band at the top of the paper scale.

Three sizes of hydrometer are given to meet the dairy industry's need to deal with milk samples of different volumes. Two scale ranges are provided for each size. The intermediate size of hydrometer has been modified to provide a more robust instrument.

Included in the appendices are particulars of a suitable thermometer for use in milk density determinations and details of cylinders in which the hydrometers may be used. The diameters of the recommended cylinders provide greater clearance for the bulbs of the hydrometers than was recommended in the previous edition.

Copies of this standard may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1.

Paul Instrument Fund

Awards of grants by the Paul Instrument Fund Committee have been made as follows:

£1,400 per annum for two years, in supplement of a previous grant, to Prof. G. F. J. Garlick, department of physics, University of Hull, for the continuation of work on solid state light image amplifiers.

£2,000, in supplement of a previous grant, to Prof. D. Gabor, professor of applied electron physics at Imperial College in the University of London, and Dr. D. Jones, for additional equipment for use in connection with the development of an electron interference microscope.

£1,000, in supplement of a previous grant, to Dr. H. B. Barlow, assistant director of research department of physiology, University of Cambridge, and Mr. P. E. K. Donaldson, technical officer, physiological laboratory, University of Cambridge, for further work on the development of (*a*) a device for automatically improving coding of messages and (*b*) a diffused storage sequence engine.

X-Ray Spectrography of Plant Material

(*Concluded from page 31*)

thus for any plant material,

$$\frac{F/S - I}{0{\cdot}168} = \mu\text{eq Sr per g.}$$

The reason for the standard curves being parallel for different plant species instead of superimposed is primarily due to the differing amounts of strontium in the samples, but general composition also appears to have some effect. The need for obtaining standards with a general composition as near the unknown as possible is now readily apparent. It seems likely that to reduce as much as possible the variability caused by differences in general composition, it may well prove desirable to adopt this technique for obtaining a general expression of content of the element under determination, even when chemical analysis of standard samples is possible.

X-ray fluorescence spectrography of plant material is in its infancy as a technique and the full possibilities have yet to be exploited, either of existing instruments or of the more versatile equipment that will certainly be developed. For the present, more widespread adoption of the technique is likely to be restricted by the initial cost of the equipment.

I am greatly indebted to Dr. L. D. Whittig for the hospitality of his laboratory and for invaluable discussions, and to Dr. P. R. Stout for demonstrating his method of compressed disc preparation.

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THE ANNUAL EXHIBITION OF THE INSTITUTE OF PHYSICS AND THE PHYSICAL SOCIETY

This year's Exhibition will be held at the Royal Horticultural Society's Old and New Halls, Westminster, London, S.W.1. from January 16 to 20, 1960. This preview of some of the exhibits will provide intending visitors with a guide to what may be seen on the stands of participating firms and Research Establishments.

Admiralty Research Establishments (Stand 135)

Instruments from many of the laboratories coming under the aegis of Admiralty Research Establishments will be shown on this stand. We give a brief résumé of some of these exhibits:

Admiralty Engineering Laboratory, West Drayton, Middlesex.—The vortex tube to be shown has been used successfully to supply cool air to a suit designed to protect the wearer in hot environments. Adequate mobility is attained with a convenient length of supply hose, the heat transfer problem being eliminated by cooling the air immediately before use.

Admiralty Oil Laboratory, Brentford, Middlesex.—Here will be exhibited a miniature fluid velocity indicator which provides a means for obtaining the velocity profile of any fluid.

Admiralty Materials Laboratory, Holton Heath, Poole, Dorset.—The portable dissolved oxygen meter to be demonstrated has been developed for the measurement of the dissolved oxygen concentration in a 250 ml. sample of boiler feed water, both in the presence of normal impurities and in water saturated with hydrogen.

Admiralty Surface Weapons Establishment, Portsdown, Hants.—The two exhibits coming from this Establishment will be the high speed symbol writing equipment (electronic writing on a cathode ray tube) and a new development in servo amplifiers.

Services Electronics Research Laboratory, Baldock, Herts.—Three exhibits here—a compact pulsed generator of fast neutrons consisting of a sealed-off discharge tube in which deuterium ions are accelerated at up to 100,000 volts on to a tritium loaded target to produce 14 MeV neutrons, an S-band cyclotron wave amplifier and a 5 kW C.W. X-band travelling wave amplifier.

Admiralty Department Works, Haslar, Hants.—An electrically propelled 16 ft. model will be used for measuring the response of the hull when running on a number of different courses with respect to waves in a ship tank.

H.M. Underwater Detection Establishment, Portland, Dorset.—A number of electronic instruments which have been developed for research and for test and repair of asdic equipment ashore and afloat will be the main exhibits here.

VISIT THE U.T.P. STAND No. 78

Enquiries concerning their publications in the instrument and research field will be welcomed by United Trade Press, Ltd., at Stand No. 78. Among the journals and publications to be displayed will be: *Laboratory Practice, Instrument Practice, Automation and Automatic Equipment News, Radio & Electronic Components,* **'Course in Industrial Instrument Technology.' 'The Instrument Manual', 'Electrical Measuring Instrument Practice,' 'Laboratory Control of Dairy Plant,' and 'The Industrial Application of pH Measurement and Control.'**

Advance Components Ltd. (Stand 86)

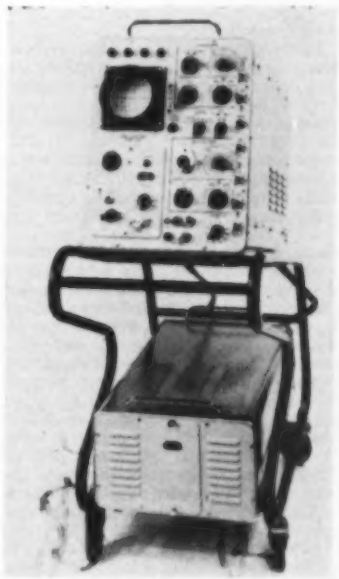
Among the new products to be seen on this stand will be the 10 Mc/s transistorized measuring counter type TC.2, transistor tester type TT.1, Q meter type CM.1, sound spectrometer type SPM.1, power supplies types PP. 2 and 4, UHF attenuators types A.100 and A.101.

The sound spectrometer is an accurate stable lightweight instrument with its own battery power supply and completely self-contained. This new instrument is of advanced design and ideally suited for sound measurement problems and analysis. With the built-in octave band filters, rapid analysis of noises having complex spectra is possible. It can also be used with a suitable vibration pickup for vibration analysis in the audio frequency range.

The other item for which particulars are available is the transistorized stabilized d.c. supply type PP. 2—a heavy duty power supply designed for the engineer developing transistorized equipment, and provides a stabilized d.c. voltage over the range 0-50 V at currents up to a maximum of 10 amps.

Airmec Ltd. (Stand 46)

A selection of recent developments will be shown, notably the high speed oscilloscope type 294. This is an extremely versatile laboratory instrument, its wide range of sweep speeds and the wide frequency response and short rise time of the Y amplifier making it ideal for high speed pulse applications.



Airmec high-speed oscilloscope type 294.

Accurate calibration of the time bases and deflection amplifier, provision of time and voltage markers, and comprehensive sweep delaying and triggering facilities make the instrument particularly suitable for laboratory measurements.

At the other end of the frequency scale, two new instruments for workers in the very low frequency field, the signal generator type 257 and phase meter type 281, will also be on view.

Associated Electrical Industries Ltd. (Stand 131)

Details of equipment to be seen on this stand are as follows:

AEI Research Laboratory, Aldermaston.—Automatic data processing equipment used in thermonuclear research; alignment devices.

AEI (Rugby) Ltd.—Recent developments in phosphor research; new glass systems; developments in semi-conductors.

AEI (Woolwich) Ltd.—Developments

in industrial valves, cathode ray tubes, ceramic valves and photo multipliers; portable electroencephalograph incorporating Polygraph recorder; leak detection equipment; Penning vacuum gauge and control unit; transistor stabilized power supply units; new principle in quadrature modulation systems for single sideband generation; transistor circuit analogue; cadmium sulphide photocells; arc discharge lamps new telecommunications systems.

AEI Lamp and Lighting Company.—Light sources of daylight quality for colour matching purposes; high efficiency linear sodium lamps and characteristics when dimmed.

AEI (Manchester) Ltd.—Two groups here: (*a*) Research (cathode etching of metals; pneumatic gauging of internal bores of tubes; measurement of rubbing properties of materials at high speeds, etc.). (*b*) Scientific apparatus (LD-2 mass spectrometer leak detector; x-ray microanalyser with scanning attachment and range extension; do-it-yourself pump kit; type S valves, etc.).

Baird & Tatlock (London) Ltd. (Stand 136)

Among the B.T.L. instruments to be shown will be the Auto-Titrator which is equipped with a wide range of facilities for simulating and testing a variety of applications. The value of polarography in the laboratory, particularly for the determination of trace metallic impurities in commercial chemicals has long been recognized. The Analmatic process monitoring polarograph, also to be shown, places this well-tried technique of chemical analysis at the disposal of the process and quality control chemist.

Other exhibits on this stand will include the portable dissolved oxygen meter designed for measurements on samples in bottles, the automatic curve-plotting titrator which can be used for any potentiometric titration and records the titration curve relating the electrode p.d. or pH to volume of titrant, the multi-detector gas chromatograph for fuel gases and the mercury piston—this offers a semi-automatic motorized or manual arrangement for obtaining a direct digital read-out of meniscus displacement.

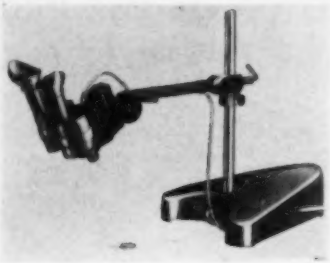
C. Baker Instruments Ltd. (Stand 92)

Among the exhibits to be seen on this stand will be:

Metalette Inverted Metallurgical Microscope.—This inverted microscope has extremely wide ball bearing focusing slides, lever and scroll focusing actuated by vertical concentric focusing knobs and high impact Polystyrene 'wrap round' case, and is designed to use the Wayne Kerr 'electronic micrometer.'

Patholette.—The production model of the prototype as shown last year.

McCarthy Phase Contrast Apparatus.—In immunology and virus work and



Baker Sterimag with eyecups.

other studies, cells are grown in a medium in an ordinary cylindrical test tube and it is desirable to examine these by phase contrast microscopy. This is not possible with the ordinary phase contrast microscope, but it is possible with the apparatus to be exhibited which has been proposed by Dr. McCarthy of Liverpool University. Corrections are made both for the astigmatism and the distortion caused by the test tube.

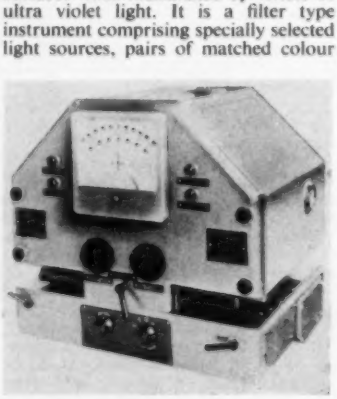
Flat Field Microscope Objective x.40 N.A.0.70.—This flat field objective is of comparatively simple construction and is comparable in price with ordinary achromatic objectives of similar numerical aperture.

Sterimag x.20.—The x.10 version of this stereoscopic magnifier has been exhibited previously. The instrument to be shown this year has several modifications to improve comfort for use. The focusing knobs have been increased in size and eyecups are provided.

Baldwin Industrial Controls (Stand 127)

A comprehensive selection of instruments will be shown on this stand, among which will be three new units—the Colormat, the portable mains operated beta gauge and the automatic self-check nucleonic gauge.

The Colormat has been designed for measuring and comparing the colour of surfaces when illuminated by visible or ultra violet light. It is a filter type instrument comprising specially selected light sources, pairs of matched colour



The Baldwin Colormat.

filters and specially matched photocells. Light from a single selected source is channelled along twin systems to both the standard and specimen samples and reflected through iris diaphragms and filters to the photocells. A pair of secondary standard white Vitrolite tiles, which have been calibrated for each filter against magnesium oxide, are supplied with the instrument.

The portable mains operated beta gauge has been designed to meet the requirements of those sections of industry where the expense and refinements of the standard beta gauge are not justified and the automatic standardizing beta gauge has been designed for use in those industries where extreme accuracy in measuring must be maintained without the necessity of operator control.

Barr and Stroud Ltd. (Stand 60)

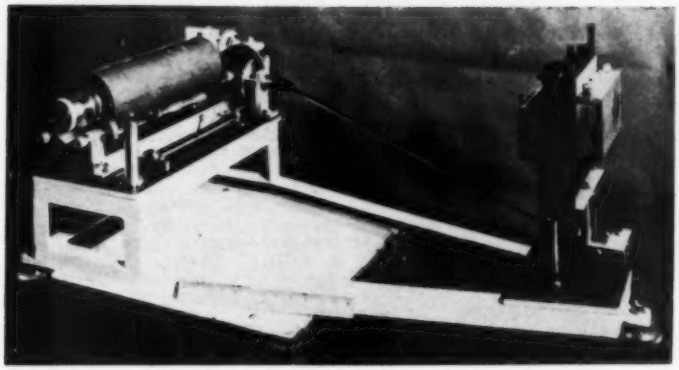
The ultra-high-speed framing camera which will be on view is capable of exposing film at rates of up to 8,000,000 frames per second. Such a camera has many applications in research and can be used for recording rapid events in experiments ranging from small-scale laboratory work to nuclear explosions. During exposures, light from the event passes through the objective lens and shutter assembly and is then reflected from a rotating mirror on to the film. The latter is carried in a curved track at the top of the camera. Between the mirror and the film, a row of matched lenses is interposed to project the light-beam on to the film, so forming there a corresponding row of separate pictures or 'frames'. The mirror can rotate at a maximum speed of 6,000 revolutions per second; it is driven by a small air turbine.

The event must be timed to occur at the instant when the rotating mirror is at a suitable angle, and, to achieve this, an electronic synchronizing unit is supplied with each camera. The input signal to this unit is derived from a photo-cell in the camera which receives a light-pulse off the face of the mirror, when this is correctly placed. The synchronizing unit then triggers off the event and can also initiate the operation of a Kerr Cell, or a blast shutter, after the main beam has traversed the film track.

Other items on this Stand will be a 70 mm. recording camera, an optical height and stagger gauge and a rapid cassette changer for cerebral augiography.

R. & J. Beck Ltd. (Stand 93)

On this stand many demonstration models will be on view, including the Optomax microscope with photoelectric exposure meter, one metre research cathetometer, null-point absorptiometer, micro-hardness testing microscope, research optical bench and contact lens spherometer with projection head.



Evolute camera unit.

Of particular interest is the prototype of a new instrument developed in collaboration with Dr. R. H. Kay of the University Laboratory of Physiology, Oxford. This new absorptiometer avoids some of the more common deficiencies of filter photometers and promises speedy and accurate determinations of, for example, blood oxygen saturation, plus a sufficient versatility for use in general biochemical and chemical assay. Test and comparison beams are balanced by the use of interference filters and a pair of linearly opposed neutral density chromel wedges.

The British Iron and Steel Research Association (Stand 53)

Four exhibits will be shown by the Association at this year's exhibition. These will be as follows:

Evolute Camera Unit.—Designed to reproduce on a single flat plate an image of the complete surface of a cylindrical specimen. It has been used to make permanent records of the condition of short lengths of cast iron and steel pipes after they have been subjected to soil corrosion.

Strip Surface Finish Inspection.—The exhibits under this heading will demonstrate techniques employed at BISRA in developing instrumental aids to visual inspection, as well as for studying the feasibility of fully automatic high speed inspection during the manufacture of tinplate and cold rolled strip. Also under this heading comes contrast enhancement by closed circuit television and critical illumination angle and a multi-channel photoelectric scanner.

Exo-Electron Testing Apparatus.—It is generally accepted that low-energy exo-electron emission in the case of metals is caused by crystal imperfections in freshly formed or distorted oxide layers resulting from plastic deformation. Exo-electron emission has therefore been used to study such surface phenomena as oxidation, mechanical abrasion and metal fatigue. The present apparatus has as a detecting element an electron multiplier. This must, however, be contained with the specimen under examination within a high vacuum chamber. A prototype of this apparatus will be on show.

Measurement of Strip Speed.—BISRA is developing a new method in which two photocells are set on two illuminated spots on the strip surface, the two spots being a fixed distance apart and lying along the passline. Small irregularities in the light reflected from the strip surface give rise to a pattern in the output of the first photocell. After an interval of time, depending on the distance apart of the two photocells and the strip speed, another similar pattern appears in the second photocell. Thus, if the output of the first photocell is delayed and then added to the second photocell signal, a maximum combined output will be obtained when the delay time introduced is equal to the time for passage of a point on the strip surface between the two photocells. From this delay time, and the known distance between the illuminated spots, the strip speed can be readily calculated.

C.N.S. Instruments Ltd. (Stand 59)

A read-out extensometer, a saturable reactor type temperature controller and the latest modification of the eddy current tube tester with chart recorder will be featured by this company. The latter item is based on a design of Aluminium Laboratories and was originally developed for the testing of small diameter aluminium tube. Subsequent development has been the extension of the frequency range to include all non-ferrous tubing and non-magnetic (e.g. austenitic) steels. The principle of operation is that when a coil carrying an alternating current is brought in close proximity to a conductor (in this case a tube) eddy current flow is set up in the conductor. The eddy currents flowing in the conductor set up external magnetic fields which link with the fields set up by the coil, modifying the apparent resistance and inductance of the coil. Alarm circuits and recording facilities are available with the instrument.

Tube tester apparatus for detecting flaws in tubes.

Cambridge Instrument Co. Ltd. (Stand 54)

A wide selection of equipment will be seen on this stand, including the Microscan x-ray analyser, the multi-point boiler feed-water analyser, carbon monoxide detector, extrusion speed transmitter, pressure transducer, dye-dilution curve recorder Mk. II, hot roll thermocouple, proportional counter for the Microscan, paramagnetic oxygen detector, ultra-microtome for cutting metals, portable potentiometer, portable four-element temperature controlled standard cell oven, a.c. comparator, pencil type oscillograph galvanometer and a pocket pH meter.

The pocket pH meter makes isolated pH measurements a simple three-minute operation and gives consistently accurate readings where a variety of processes must be constantly checked. Powered by dry cells with a life of approximately 1,000 hours, the instrument has a direct-reading scale covering the whole pH range from 0 to 14 units.

C. F. Casella & Co. Ltd. (Stand 43)

The more important of the many exhibits to be seen on this stand are the temperature and gravity compensated barometer, the long period dust sampler and the distant reading air meter. The first of these is claimed to be the first barometer made which can comply with standard conditions 0°C. and 980·665 cm.^{2}, carry a height scale and at the same time also be compensated for the Kew error. The long period dust sampler has been developed in conjunction with the National Coal Board Mining Research Establishment at Isleworth. The distant reading air meter uses a 4 in. diameter vane airmeter, the vane running in well-sealed precision miniature ball bearings which ensure long life and maximum sensitivity.

Other exhibits will include a one metre cathetometer, McIlleron perspective analyser, bimetallic actinograph, dew point meter, precision mercury column, three-cup counter anemometer and a three-cup electric contact anemometer.

Cawkell Research & Electronics Ltd. (Stand 103)

The company will be showing a number of new devices which will make use of display-storage cathode ray tubes. These devices include the Remscope, of which a new version will be shown, the Tele-Remscope which is an entirely new design and the double-beam Remscope.

A new variable filter will be on show in prototype form and will shortly be in production and the first model of an equipment to measure Young's modulus and damping capacity at extreme temperatures will be demonstrated.

Cooke, Troughton & Simms Ltd. (Stand 96)

The design of the M606602 stereoscopic microscope to be shown this year differs from the conventional form of stereoscopic microscope. Instead of having twin objectives inclined inwards so that their optic axes meet in the plane of the specimen it uses one objective, and an optical system in the body of the microscope passes left- and right-handed images to the eyepieces to produce the sensation of depth. Thus the same effect is produced as with the more usual type of stereoscopic microscope but with the advantages of a constant working distance and a flat field of view.

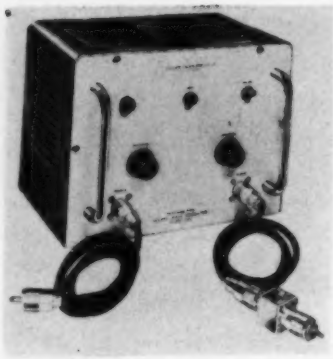
The point counting stage equipment, which enables quantitative area analyses of the various constituents to be made on thin section of rocks or other materials and has been available for some years, has been re-designed to give greater convenience of operation.

Other microscopes to be shown will be the M2505FA2 microscope with inclined binocular body, square mechanical stage and focusing controls at substage level, the M150012TN2 microscope, the M120002EQ2 metallurgical microscope and the M130001PQ Cooke-McArthur microscope — a high-class microscope in an instrument the size of a miniature camera, complete with special blood counting outfit.

Cossor Instruments Ltd. (Stand 121)

Three plug-in units for the wide-band amplifier Model 1076 will be displayed on this stand. Other exhibits will include a portable double beam oscilloscope Model 1093, oscillograph camera Model 1458, double beam oscilloscope Model 1091, wavemeter Model 1461, true R.M.S. millivoltmeter Model 1453, transistorized power unit Model 1330, fast rise time square generator Model 1090, sine/square generator Model 1463 and a one-millimicrosecond pulse generator Model 1097.

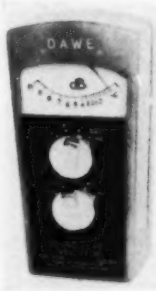
Of particular interest is the oscillograph camera Model 1458 which allows interchangeable lenses, including a fast F1.5 for high speed transient work. Three different hoods are available, allowing attachment to several manufacturers' oscilloscopes.



Cossor fast rise-time wave generator.

Dawe Instruments Ltd. (Stand 118)

One of the new items of equipment to be seen on this stand will be the type 1408D transistor sound level indicator—a plastic-cased pocket instrument with a range of 64 dB to 110 dB above the standard reference level of 0·0002 dyn/cm^2. The frequency range is 32 c/s to 8 kc/s. A crystal microphone feeds into a high impedance input circuit followed by a highly stable amplifier with standard weighting networks and a four step attenuator. The battery life is typically 90 hours and the accuracy is outstanding for an instrument in this class.



Dawe sound level indicator.

Included in the other exhibits to be seen will be a U.L.F. noise generator, transistorized audio signal generator, automatic L.F. oscillator, variable phase adaptor, transistor output power meter, a.c. milliclamp, transistor phase meter, transistorized Soniclean equipment, transistor Strobotorch, vibration control equipment and a variable band width filter.

Decca Radar Ltd. (Stand 25)

Among the items to be shown on this stand will be:

Annular Rotating Joint.—A high power rotating joint of annular construction for X band.

Coaxial Components.—A wide range of very broadband coaxial components is now available and will be displayed.

Ferrite-Swept X-Band Oscillator.—An X band klystron has been modified to incorporate a ferrite rod in the rear cavity. By varying the current in the coil placed round the ferrite, it is possible to tune or to sweep the klystron electrically over several hundred Mc/s.

Universal Klystron Power Supply.—Developed to provide the necessary operating supplies for the majority of known low-power klystrons.

Waveguide Switches.—Examples of a wide range of manual and motorized waveguide switches will be exhibited.

Department of Scientific and Industrial Research (Stand 47)

Exhibits from the following Laboratories will be shown on this stand: National Engineering Laboratory (precision radial scales, bi-directional random input counter, an extra high-pressure apparatus, frictionless propeller meter, recording stress and strain in tensile tests under high hydrostatic pressure); The British Internal Combustion Engine Research Association (radio telemetering system); Water Pollution Research Laboratory (sludge detector, suspended solids recorder); The Electrical Research Association Laboratory (film strips showing circuit-breaker principles, omni-directional gust anemometer, discharge detector model 3); The British Ceramic Research Association (new high temperature ceramics); Warren Spring Laboratory (radioactive rotameter); The British Glass Industry Research Association (automatic thermal expansion apparatus); British Welding Research Association (carrier gas method of hydrogen determination); Radio Research Station (measurement of the complex current gain of transistors at

Sludge detector in use.
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U.H.F.); Road Research Laboratory (road heating control unit, recording speed meter); The National Physical Laboratory (an analogue model of an adaptive control system, photoelectric microscope, demonstration of polarization and other features of the light from a tungsten filament, large scale model of new absolute radiometer, recording spectropolarimeter); The British Steel Castings Research Association (radioactive tracer technique investigates the origin of inclusions in steel castings).

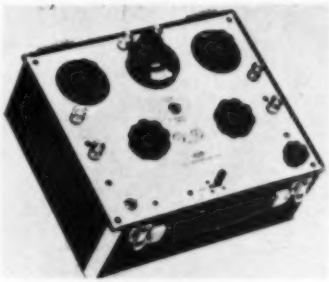
The Distillers Co. Ltd. (Stand 24)
A new type of total radiation detector, developed mainly for use in infra-red analysers, but having a wide field of application, will be shown on this stand. An evacuated cell contains the detecting element comprising a small thermocouple loop with blackened gold leaf collector discs on both junctions, sensitively suspended in a magnetic field and provided with a feedback coil and a mirror which forms part of a light beam-photocell detector system. Any difference in the amounts of energy falling on the two collectors causes a current to flow in the thermocouple loop tending to deflect the element in the magnetic field. This deflection is detected by the photocell and an amplifier provides a current through the feed-back coil which maintains the element in balance. The output from the detector thus takes the form of this feedback current which is proportional to the difference in the two amounts of energy received.

The detector is linear in response, level insensitive and shockproof. It enables simple and reliable radiational analyes to be made with a minimum of moving parts. Although only preliminary tests have been made at the time of writing an ultimate sensitivity of the order of 10^{-9} watts is expected.

The basic concept of suspending the entire thermocouple loop in a magnetic field was first demonstrated by d'Arsonval and Boys in 1886-7.

One possible application of the detector in a simple infra-red liquid analyser suitable for use as a continuous alarm monitor on a process stream will also be demonstrated.

Dobbie McInnes (Electronics) Ltd. (Stand 105)
Due to the wider interest in problems of data handling a simplified range of the 'd-mac' equipment has now been produced—called the Economac range—and examples of tape input and keyboard input graph plotters as well as trace readers will be shown. Other items on this stand will be a five-channel version of a French pen recorder, an example of the range of ultra-sensitive but shockproof Schlumberger-Picard galvanometers, and the C.R.C. oscilloscope for teaching purposes. This is a large screen oscilloscope with great simplicity of controls but very versatile in its use.



Doran portable potentiometer.

Doran Instrument Co. Ltd. (Stand 110)
Included in the instruments to be shown by this company will be:

1. *Zener diode stabilized power unit for use with the Unicam SP.500 spectrophotometer.*—The substitution of three zener diodes in place of the barretters, in addition to its more effective stabilization, reduces the output impedance of the unit and thus virtually eliminates the effect of variation of the sensitivity control of the spectrophotometer on the dark current adjustment.

2. *Precision electrometer potentiometer.*—This instrument combines the function of a precision pH measuring instrument reading directly in pH units and mVs and a d.c. potentiometer. Readings are accurate to ± 0·001 pH and ± 0·1 mV when used with a suitable external reflecting galvanometer.

3. *Polarized electrode autotitrator.*—Based on one developed in the laboratories of the University of the Sarre, this instrument enables simplicity of measurement to be obtained both for manual and automatically controlled titrations.

4. *General purpose potentiometer.*—This instrument has three measuring ranges of 0 to 1·8, 0 to 0·18 and 0 to 0·018 volts, with an accuracy of ± 0·02 per cent and with the smallest reading of 10 microvolts corresponding to one division on the slide wire scale.

5. *Portable valve millivolt/pH meter.*—A completely compact measuring unit for pH and mVs with a current drain on the measuring cell of less than 5×10^{-12} A.

6. *De-ionized water conductivity test set.*—Transistors have been introduced to provide a compact direct reading conductivity test set in which the upper range can be used for measurements up to 10 megohms in terms of resistance or 0·1 microhms in terms of conductivity.

7. *pH/controller for plating tanks.*—The circuit used in this apparatus is one that has been thoroughly tried out for both pH indications and electrometric titrations and this is combined with a moving coil indicator provided with transistor photocells which operate a moving coil relay which in turn energizes an electromagnetic valve.

Dynatron Radio Ltd. (Stand 29)
Stabilized power units designed to provide sources of stabilized e.h.t. for G-M tubes, ionization chambers and general types of photo multipliers form one section of the exhibits to be seen on this stand.

Others consist of a timing unit designed primarily to operate with the 1009 series of scaling units from which it can obtain its supplies and a test set which comprises a combined double pulse generator and measuring oscilloscope. It is designed to provide the necessary services for maintenance of the commonly used instruments in the nucleonic field, e.g. pulse amplifiers, discriminators, scalers, ratemeters and pulse height analysers. A master multivibrator controls the pulse recurrence frequency of the pair of pulses.

Ekco Electronics Ltd. (Stand 30)
Instruments and assemblies for specialized and general applications in research, medicine and industry will be shown on this stand. Of interest in the medical field is the scintillation counter which is fitted into directional shield and connected to a ratemeter. The scintillation counter can be cold-sterilized while the directional shield is provided with three alternative collimators and lights for accurate re-positioning. For hospital or laboratory use, the full equipment can be mounted on the new universal mobile stand. Under the heading of health monitoring the company will be showing a portable radiation monitor which has been designed to meet the (Preliminary Draft) Factories (Ionizing Radiations) Special Regulations. It has three ranges of O-3, L-30 and O-300 millirad/hour together with an integration range up to 30 millirads with a time constant of 15 hours. An alternative chamber can be fitted easily for very localized dose-rate measurement.

Electro Methods Ltd. (Stand 58)
During the last 12 months considerable development has taken place in the field of temperature control as will be evidenced by the items shown on this stand. Here will be seen laboratory controls for ovens and liquids using electrical contact thermometers in conjunction with the new Type 21 3B transistor relay; the temperature control of small platens using the new miniature cartridge thermostat; and stepless temperature control using magnetic amplifiers and saturable reactors for both research and industrial purposes.

Other items to be shown on this stand will be a new educational magnetic amplifier for use by technical colleges and similar institutions. This unit allows the saturable cores to be connected in a variety of the more common arrangements in general use. Also on display will be examples of the latest developments in electro-mechanical integrators and integrating motors together with a new high speed photoelectric relay.

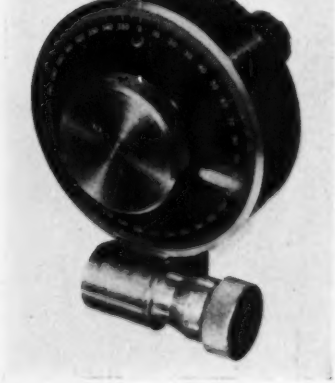
Electrothermal Engineering Ltd. (Stand 5)

Highly concentrated heating is obtained by focusing the heat sources optically upon the section or object to be heated. As the heat is transferred by radiation there is no danger of contamination, and the heating element being remote allows the unit to be placed over evacuated tubes. This type of heater has so far been applied to vacuum zone refining, to soldering, to sintering of alloys and to sample heating during physical examinations, e.g. microscopic, magnetic and x-ray diffraction. There are indications that it may also be used as a means of testing the combustibility of polymeric materials in an effort to improve the reproducibility of existing test methods (Baum, F. J. Rev. Sci. Inst. Vol. 30, No. 11, Nov. 1959 p. 1046 'Radiant Energy Zone Heating Unit').

Temperatures in excess of 1,200°C. have been obtained on the inside of ½ in. diameter crucible in air. The model to be exhibited has been adapted for demonstration purposes only. Specific applications can be considered.

Elliott Brothers (London) Ltd. (Stand 125)

Many associated companies and divisions will have exhibits on this stand and from the Automatic Test Equipment Division of Elliott Brothers will come the programmed automatic circuit-checking equipment which has been designed to facilitate the routine checking of complex cable-forms, or similar constructions, completely automatically by programming the test requirements into the machine. Also from this Division will be the automatic second-line test set and micrometer dial. This latter item has been designed to provide a quick and easy method of setting an angular displacement, to the nearest minute of an arc on a variety of small electrical components such as synchros and potentiometers, with a high degree of accuracy, in the order of plus or minus 15 seconds of an arc.



Micrometer dial by Elliott Brothers (London) Ltd.

The Inertial Navigation Division will be featuring the standard cell temperature controller type No. 75D 1020 and the standard frequency receiver unit type No. 75D 1547. The Microwave and Electronic Instruments Division will be showing a range of analytical instruments and components and amplifiers of different types. Elliott Nucleonics Ltd. will include a comprehensive d.c. trip amplifier, shut down amplifier, gamma compensated ion chamber E.H.T. supply and a comprehensive scaler designed for both industrial and experimental applications.

English Electric Valve Co. Ltd. (Stand 50)

This year the English Electric Valve Company will provide a display more in keeping with the original aims of this exhibition and a brief description of the four main exhibits is given below:

Demonstration of High Gain Image Intensifier.—An image intensifier tube has been developed with an overall gain of about 80,000. A tube of this type will be mounted in demonstration equipment so that it will be possible to see the amplification and resolution obtainable when viewing a very weakly illuminated test chart.

Demonstration of Low Noise Amplifier Unit.—This will show a 600Mc/s parametric amplifier complete with focusing unit, power supply and 'baluns' (matching units) all designed as compatible accessories.

Storage Tubes.—Two new prototypes will be on show. The E701, a direct view storage tube, intended for bright radar displays; and the E709, a picture storage tube with electrical input and output.

Advances in Valve Manufacturing Techniques.—Piece parts and sub-assemblies, for a ceramic tetrode type 6181 will be shown, together with a finished valve. They will show among other things, the ceramic seals, and accurately formed grids.

Ericsson Telephones Ltd. (Stand 115)

The Instrument, Electro-mechanical, Physics and Tube Divisions will share this stand. The main exhibits of the former will be the E.T.L. digital data link equipment and unitized nucleonic equipment, both being shown as working exhibits. The unitized nucleonic equipment has been designed to provide a versatile and economical system for constructing equipment to meet any nucleonic counting application and comprises a comprehensive range of units, each of which performs a particular function within a precise specification. Suitable units from this equipment will be used to demonstrate low energy coincidence counting.

Seven exhibits will be shown by the Electro-mechanical Division: photocell-controlled street lighting installation, magnetic shaft speed transducer, micro-signal chopper, multiple miniature relay unit, relay type 53 Mk. I and Mk. II, relay type GPST, plug in and polarized G.P. relay.

The EEL Spectra.

The Physics Division will give a demonstration of conveyor belt counting using photoconductive cells as sensing element, showing the use of phosphotrons in remote slave number displays, a demonstration of the display of numbers and symbols using phosphotrons, a demonstration of a phosphotron alphabet display type P.40 controlled by remote push button unit and a static display of the range of stand Phospholite panels.

Digitrons, trochotrons, dekatrons, trigger tubes, spark gaps, and stabilizer and reference tubes will be featured by the Tube Division.

Evans Electroselenium Ltd. (Stand 12)

The four main exhibits on this stand will be the prothrombin meter, the Spectra, a recording flame photometer and a chloride meter. The prothrombin meter has been designed to measure automatically the clotting time of plasma samples either by Quick's one-stage technique, Orwen's P and P method or by the more recently introduced thrombotest. It operates on the principle of the photoelectric absorptiometer and provides a means of detecting the end-point of clotting without the errors inherent in a visual assessment.

The EEL Spectra is a new instrument combining the simplicity and convenience of routine colorimetric equipment with the high performance and versatility needed for research and the recording flame photometer has been designed primarily for the continuous measurement of sodium concentrations. With slight modifications it can also be employed for determinations of potassium, calcium and lithium.

The chloride meter has been designed

for the automatic determination of chlorides in serum. Only the operation of a single control is required to give a reading and the instrument is calibrated to record directly in Meq/l chloride, readings being clearly indicated on a digital counter.

Furzehill Laboratories Ltd. (Stand 10)

Featured on this stand will be:

Differential Double Beam Oscilloscope.—Two identical vertical amplifiers providing differential input on each channel feed a 5 in. flat faced double gun c.r.t. Bandwidth/sensitivity is zero to 150 kc/s (3 dB) from 50 V/cm. to 5 mV/cm.; zero to 100 kc/s (3 bB) at 1·5 mV/cm., with common mode rejection better than 100:1. Instrument provides time and voltage calibration and a wide range of time base sweep speeds. Provision is made for one of the vertical amplifiers to be coupled to the horizontal deflectors enabling the instrument to function as a curve tracer with identical amplifier facilities on each axis.

V.H.F. Spectrum Analyser.—Operating in the frequency range 25 Mc/s to 140 Mc/s, the equipment provides a panoramic display on a cathode ray tube, over a frequency band variable between 0 and approximately 50 per cent of the tuned frequency. Vertical deflection provides a logarithmic or linear display for amplitude evaluation.

Incremental Inductance Bridge.—The equipment comprises three units: the bridge, a variable d.c. polarizing supply and an excitation oscillator. Measurements may be made over the range 50mH to 500H (alternatively 5mH to 50H) with polarizing current up to 2A and at any excitation frequency from 25 to 3,000 c/s. The bridge incorporates a tunable frequency selective amplifier to ensure sharp null indication and gives a resistive balance from which Q may be calculated. The excitation oscillator provides up to 10 watts via a matching transformer giving a number of alternative impedances.

Sensitive Differential Oscilloscope.—The instrument provides a maximum vertical sensitivity of 1·5 mV d.(c.)/cm and differential input facilities of particular value in the measurement of small potential differences which may themselves have a relatively high in-phase signal potential to earth.

A. Gallenkamp & Co. Ltd. and J. W. Towers & Co Ltd. (Stand 128)

The automatic standard distillation apparatus originally developed by Shell has now been expanded and includes a refrigerator unit which is used to cool the condenser tank of the apparatus for the distillation of materials having highly volatile fractions. This new equipment will be shown on this stand together with a manipulator glove box (developed for handling radioactive materials in a controlled atmosphere), a ballistic bomb calorimeter (which provides a rapid

Gallenkamp flame photometer.

method of determining directly the calorific value of foodstuffs), Lloyd apparatus (a compact instrument employing chemical methods for the determination of oxygen and carbon dioxide in gases), and a flame photometer (a redesign of an earlier instrument designed primarily for routing testing in clinical laboratories). In this latter unit which employs a built-in galvanometer, filters for sodium and potassium analysis only are fitted, The speed of response is particularly high and the complete analysis may be performed with small quantities of materials. Excess fluid from the burner system is led via siphon drain to a conveniently placed collection point. The galvanometer suspension employed is robust and the unit is substantially free from errors caused by vibration and dust.

The General Electric Co. Ltd. (Stand 132)

On this stand the research laboratories of the G.E.C. will be showing a range of thermoelectric cooling assemblies having cooling powers ranging from a fraction of a watt up to about 10 W when they are operated with a temperature difference across the junctions of 40°C. Other developments will be magnetic films for information storage, a high efficiency post-deflection acceleration cathode ray tube, semiconductor devices, a new process—the regrown diffused process for making transistors (process to be shown in a short film), fluorescent lamps, the use of iodine in tungsten filament lamps for the reduction of the evaporation rate of tungsten from the filament, and a wide-band ferrite switch for use in X-band.

The General Electric Co. Ltd. (Stand 130)

The G.E.C. Semiconductor Division will be showing a selection of devices from its wide range of transistors, diodes and controlled rectifiers on this stand.

Guy's Hospital Medical School, Physics Department (Stand 142)

The radiofrequency electron spin resonance spectroscope to be shown on this stand works on the same principle as the conventional 3 cm. apparatus but at a wavelength of one metre and uses a quarter wave resonant line situated in a field of 100 gauss. Its chief advantages lie in the fact that it is much more portable than the high frequency apparatus and that at this lower frequency dielectric losses in water are reduced and hence large samples with a high aqueous content can be examined. The instrument is intended for investigation of free radicals produced by irradiation.

Hilger & Watts Ltd. (Stand 133)

Among the items to be shown on this stand will be eight new instruments as follows:

The Ultrascan H 999.—A double beam recording spectrophotometer for routine analysis in the range from 200 to 750 mμ.

Arndt Single Crystal Diffractometer.—This linear diffractometer automatically measures x-ray reflections from single crystals.

The Fluroprint Y 150.—A fully automatic x-ray fluorescence vacuum spectrometer for the routine analysis of large numbers of samples in solid, liquid or powder form.

Fluorimeter H 960.—Suitable for a wide range of routine analyses.

The Microspin.—Electron spin resonance spectrometers using microwave frequencies in the Q-band and the X-band, developed in co-operation with Microwave Instruments Ltd.

The Duochromator E 222.—A two-channel direct-reading spectrometer intended mainly for instruction on direct-reading spectrochemical analysis in universities, technical colleges and similar institutions. Also suitable for some simple analyses in industry.

High-power Microfocus Unit Y 33.—This unit has interchangeable guns which give focal spots of the following sizes and powers:

(*a*) 40 microns diameter, 50 Kv d.c. 400 A.

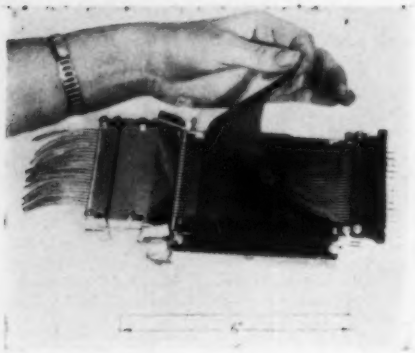
(*b*) 1·4 mm. × 100 microns, 50 Kv d.c. 3 mA.

(*c*) 6 mm. × 100 microns, 50 Kv d.c. 10 mA.

The Carlsson Attachment E 761.—This is a direct-reading attachment to the medium quartz spectrograph which can have up to eight exit slits and photomultipliers.

International Computors & Tabulators Ltd. (Stand 2)

Magnetic thin films will be the theme of this stand. Of especial interest is the magnetic film store plate tester which is fully transistorized and is virtually part of a computer using a thin magnetic film store. The tests are designed to simulate operation in a computer store and are arranged so that the plate may



Thin file matrix magnetic storage under development in the I.C.T. Research Laboratories at Stevenage.

be quickly accepted or rejected for assembly into a store. Complete tests on all 1,250 storage elements can be made in a few seconds. A magnetic film digital store will also be shown together with a demonstration showing how the coherent rotation process can be exploited so that magnetic films can be used to store information in binary form.

Isotope Developments Ltd. (Stand 41)
On this stand will be seen a chromatogram scanner for the measurement of chromatogram strips labelled with radioactive isotopes such as Cl4, a coincidence scintillation counter designed to meet the requirements for measuring millimicrocuries of low-energy-beta emitting isotopes, a Geiger-Muller tube counting assembly, a double channel pulse height analyser, an alpha spectrometer assembly, automatic sample handling and recording, an electrometer for the measurement of the current caused to flow through a gamma-sensitive ionization chamber by the background radiation in the exhibition area, and an electrometer which will be demonstrated charging and reading BD11 ionization chambers.

Other equipment to be shown consists of NOLA, a non-overloading amplifier and an isotope carrier comprising two nesting lead containers which may be used separately or together, mounted on a simple wheeled trolley.

Kelvin Hughes Ltd. (Stand 104)
A new type altimeter, designed to meet the needs of contemporary high flying, high speed aircraft and a new pen recorder offering a choice of either curvilinear or rectilinear traces will be two new developments to be seen on this stand, which will also combine exhibits from Smiths Industrial Division and Kelvin & Hughes (Aviation) Ltd.

Other items to be seen will be a precision tachometer which abolishes the need for a reduction gear between the engine and speed measuring element, a series of fluxgate magnetometer elements, a pitot-static test unit, and true airspeed computer.

In the industrial field a data handling system designed to give the greatest flexibility of application and capable of scanning and logging an unlimited number of process variables will be shown. The system, including transducers and power supplies, is housed in a cubicle-type panel, the units being rack-mounted for ease of servicing.

Lintronic Ltd. (Stand 32)
High-speed digital data recording systems are the particular interest of this company who will be showing a transistorized commutator for mV signals, a memory store of a digital data recording system, a fully transistorized pulse pattern generator, a differential pressure pulsating flowmeter and a turbulence detector.

Marconi Instruments Ltd. (Stand 98)
Examples from the Marconi Instruments range of telecommunications measurement equipment will be shown, including two entirely new instruments—the low-frequency generator TF 1382 and the suppressed-zero voltmeter TF 1377. Representing the company's industrial range of equipment is the new laboratory pH meter TF 1093. This is a mains-operated high-stability pH meter providing a direct reading of pH from 0 to 14. Any section of the scale can be expanded over a centre-zero incremental range of ± 1·4 pH, enabling small changes in pH to be measured with a discrimination of better than 0·01 pH; the main and incremental ranges are provided with independent buffer controls to enable accurate cross-correlation to be carried out. There is a ± 2 pH increment switch for buffer solution extension or self-check. Full automatic compensation for solution temperature is provided on both ranges. The instrument also measures voltages in the range 0 to 1,400 mV and ± 140 mV with the same high input impedance and stability as for pH measurement. This extends its use to such applications as rH or corrosion-potential measurements.

Marshall of Cambridge Electronics Ltd. (Stand 117)
Among the items to be seen on this stand will be the improved pulse height analyser using the Hutchinson-Scarrot principle, a scaler (Type 200) the first of a new range of transistorized counting and timing devices based on a novel decade counting ring using a minimum number of transistors, a magnetic pulse recorder (a fully transistorized instrument designed to enable pulses from nuclear radiation detectors to be permanently recorded in analogue form), and a twin channel pulse generator. Also on show will be transistorized power supplies types 221 and 221P.

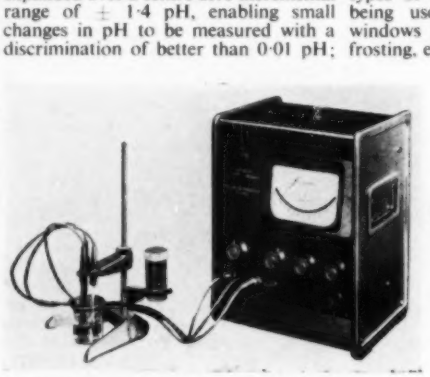
Megatron Ltd. (Stand 45)
The following exhibits will be seen on this stand:

Selenium Photo Cells.—A range of different shapes and sizes of mounted and unmounted selenium photocells with different spectral characteristics, together with improved 'potted' selenium cells, tropical fast and resistant to chemical attack.

Light Meters.—Besides the well known range of cosine corrected light meters C1-C3 and C5a, an integrating light meter developed in co-operation with National Institution of Agricultural Engineering will be shown.

Colour Temperature Meter.—This is widely used by photographers and in colour printing.

Electrically Conductive Glass.—Samples will be shown of three different types of coatings on glass which are being used on antistatic instrument windows and for de-misting and de-frosting, electro-luminescence, etc.



Marconi laboratory pH meter, type TF 1093.

Mervyn Instruments (Stand 119)

The Mervyn-Harwell square wave polarograph Mark III will be seen on this stand, together with the plant stream gas analyser Mark II (for the measurement and recording of the amount of one component in a multi-component gas stream), a large potentiometer recorder/plotter which has a chart width of 30 in. and a full scale response time of ¼ sec., a portable transistorized self-balancing potentiometer recorder and a non-overloading high speed pulse amplifier.

Examples will also be shown of synthetic materials produced by the Bridgman-Stockbarger process—principally halides of the alkali and alkaline earth metals. A special feature of these crystals is their high transmission and controlled structure.

Metals Research Ltd. (Stand 95)

On this stand will be shown a selection of Pyrotubes—a new type of high temperature heating element capable of heating furnaces to 1800°C. Also on display will be the Servomet—an adaptation of the spark erosion process for use in metallurgical laboratories. It has proved an invaluable means of rapid, accurate and strain-free machining of all types of metallurgical specimens.

The company have also developed techniques for growing, orienting and machining crystals of many metals and alloys and examples of these will also be exhibited.

M-O Valve Co. Ltd. (Stand 129)

An addition to the range of transmitting valves on view will be a new 20 W triode (E2910) capable of working up to 1500 Mc/s, and for use under conditions of extreme vibration and shock. Another new transmitting valve to be shown is a pulsed or C.W. oscillator triode (E2908) usuable up to 600 Mc/s.

Morgan Crucible Co. Ltd. (Stand 36)

The exhibits to be displayed on this stand illustrate some of the techniques and materials developed by the Morgan Crucible Group. The instruments to be exhibited have been constructed for internal research purposes only, but the materials and devices to be shown can be supplied in commercial or experimental quantities. High temperature thermocouples. Crusilite concentrated source heating elements and Morganohm Grade nine non-linear resistors will be demonstrated.

An interesting item is the technique which has been developed to follow under a microscope the slow changes in crystal form, or other visible qualities of solid materials. The material is placed on an electrically heated metal strip and illuminated by ultra violet light. A camera gun is used to photograph the changes at minute intervals, and the film is then run at normal rate.

Newport Instruments (Scientific and Mobile) Ltd. (Stand 22)

A demonstration will be given on this stand of the measurement and adjustment of the field homogeneity of an electromagnet, using instruments employing nuclear magnetic resonance and electron spin resonance techniques which have been developed for this purpose. The magnet used is a standard Newport 7 in. electromagnet type E, with adjustable gap. Special 7 in. diameter poles and pole tips are fitted. The alignment is adjustable. The power unit supplying the magnet is a new addition to the Newport range, and is designed to achieve high stabilities even under adverse conditions of mains supply fluctuations, and to achieve very low values of field ripple.

Muirhead & Co. Ltd. (Stand 28)

Among the items to be shown on this stand are an automatic recording wave analyser (K-100), a precision R.M.S. decade voltmenter (D-930), a high frequency analyser-oscillator (D-888) a precision decade oscillator (D-890) and a transfer function analyser. Three new transistorized units will be on display and a wide selection of servo components and test equipment.

Also on show will be two items of test equipment for torque receiver testing; a fully automatic receiver following accuracy test set for 60 and 400 c/s receivers, sizes 11 to 23, providing a permanent chart record of the following error; and a unique synchronizing time indicator for measuring the settling time of any type of receiver.

National Research Development Corporation (Stand 139)

Two of the exhibits to be shown by the Corporation will be the frost point hygrometer and the stereoscopic rangefinder. The hygrometer is a continuous sampling device but it can easily be modified to sample fixed quantities of air. It has also been constructed so as to indicate the frost point temperature on a meter, but it can easily be modified to provide a record or control other equipment.

The stereoscopic rangefinder indicates three distances simultaneously. The instrument will be of great assistance to anyone engaged in still or cine photography of subjects likely to move quickly as adjustments to ensure that the subject lies within the indicated depth of field can be made rapidly and continuously.

N.G.N. Electrical Ltd. (Stand 83)

Among the six items to be shown on this stand will be a general purpose laboratory pump unit. This is a combination hand controlled 25 litre per second pumping unit on which the high vacuum connection is taken via a right angled baffle valve. This was developed specifically for applications in which refractory tubes are mounted horizontally and immersed in baffle furnaces or ovens for metallurgical investigations. Other items will be rotary piston pumps, magnetic vacuum valves, automatic pumping unit, bench McLeod gauge and demountable unions and couplings.

New Electronic Products Ltd. (Stand 62)

Various types of pressure transducers and recorders will be shown on this stand. They will include temperature stabilized pressure transducers, a wind tunnel pressure transducer, a pressure transducer for use with radioactive media, and medical pressure transducers and carrier amplifiers. A very high frequency pen recorder and a new ultra violet recorder will also be featured, together with a miniature electro cardiograph which has been designed to provide the cardiologist with an inexpensive, portable and simply operated means of recording electro-cardiograms.

L. Oertling Ltd. (Stand 109)

A wide range of balances will be seen on this stand. For example, the quartz fibre decimicrobalance, a semi-automatic balance designed to weigh loads of up to 2 Kg. to an accuracy of 0·1 g., one-pan balances and two-pan balances (both new models in this category) and a new series of adjustable analytical weights in non-magnetic stainless steel. More sets will be available than were shown last year.

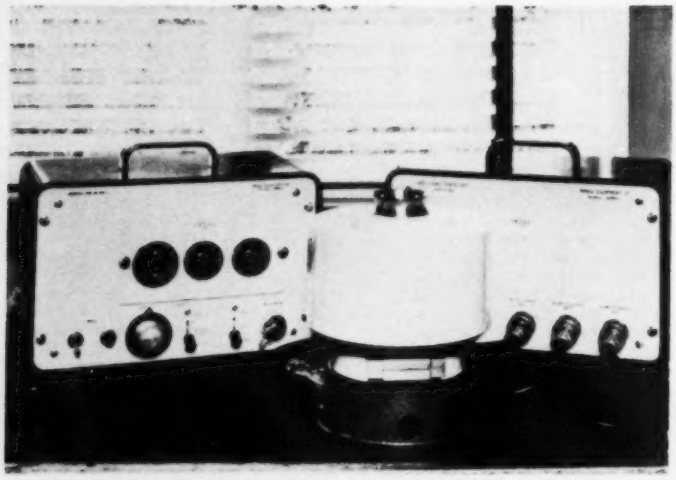
W. Ottway & Co. Ltd. (Stand 91)

On this stand will be seen an indicating or recording autocollimator which measures the rotation of a mirror about horizontal and vertical axes. The instrument consists of two main parts, the colimator and the electronic control unit. Three ranges of readings are provided zero to ± 2 seconds, 0 to ± 20 seconds, and 0 to ± 2½ minutes with sensitivities of 1/10th second, one second and 10 seconds respectively. Visual readings are taken on a galvanometer which is suitably calibrated. Recording may be effected by introducing an amplifier and pen recording unit into the system. The circuit is designed primarily for an open loop system but may be converted to a closed loop with the addition of a servo system.

Another exhibit will be the opticano —a simple type of optical bench designed for use by students and for laboratory assimilation work. The main feature of the design is the constructional aspect which enables various optical instruments to be built, for example, the telescope, microscope, collimator projector, binocular systems and similar.

Panax Equipment Ltd. (Stand 85)

Apparatus which is particularly useful for the measurement of very low activity samples will be one of the items to be seen on this stand. This high sensitivity low background Geiger count-



Panax high sensitivity low background Geiger counting equipment.

ing equipment comprises a lead castle designed to house a small mica window beta counter arranged inside a guard counter with provision for the use of standard one inch diameter planchets and absorbers or alternatively strips of paper chromatograms, an anticoincidence unit which incorporates a fully stabilized e.h.t. supply for the guard counter and a compact two decade scaler which has a variable and fully stabilized e.h.t. supply for the thin mica window counter.

Other exhibits will be a high sensitivity scintillation flow counter, various types of counting equipment and a compact radiation level switch which can be used with a variety of Geiger counters to monitor the radiation level in a selected situation.

Perkin-Elmer Ltd. (Stand 49)

On this stand will be shown the Model 137UV spectrophotometer designed as a high performance, low-cost double-beam recording instrument for use in the ultra violet and visible regions of the spectrum. Spectra are recorded on a linear absorbance/linear wavelength basis over the range 190-750 mμ, with automatic changeover of the hydrogen and tungsten lamps between the ultra violet and visible regions.

The Perking-Elmer Fractometer also to be shown incorporates the latest advances in gas chromatography in a fully modular design so that the most efficient combination of sampling device, column and detector can be chosen for each individual problem. Four different detectors are available: thermistor, hot-wire, β-ionization and flame ionization types. A novel feature is the possible use of two detectors together, a conductivity and an ionization type respectively, so that special sensitivity requirements can be met.

G. V. Planer Ltd. (Stand 17)

A wide selection of equipment will be displayed here including:

Hysteresis loop test gear.—Designed for the display on a cathode ray oscilloscope of hysteresis loops and the determination of coercivity and remanence of magnetic materials.

Magnetic film memory stores.—These are magnetic film memory stores in toroidal and flat plate configuration.

Automatic vacuum resin-casting equipment.—Designed for the automatic resin casing under vacuum conditions of electronic components or assemblies.

Conductive films on glass.—These will consist of a continuous track potentiometer, a continuous response mercury levelling switch, oxide coated fibre resistors and copper/gold printed inductors on glass base.

W. R. Prior & Co. Ltd. (Stand 97)

The company will be exhibiting a wide variety of microscopes among which may be mentioned a completely new range incorporating stand units with a choice of stages, condenser, illuminators and new optical systems, a laboratory type petrological microscope, metallurgical microscopes, inverted microscopes and stereoscopic microscopes. Also to be seen will be a cinemicroscope for recording by continuous or by time lapse cinephotography movement or growth in any type of microscopical specimens. It is designed primarily for studies of living cells in controlled environments and provision is made for accurate control of the temperature of the specimen.

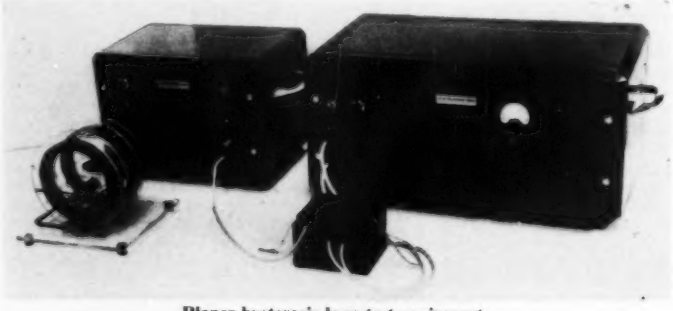
The company will also be showing a micromanipulator designed for research workers carrying out fine movements under the lower power microscope with particular application in physiology, biophysics and genetics.

Torsional vibration tester.

R. B. Pullin & Co. Ltd. (Stand 9)

The following products will be shown by R. B. Pullin & Co. Ltd. and associated company Measuring Instruments (Pullin) Ltd.:

Torsional Vibration Tester.—This instrument, manufactured under licence from the National Research & Development Corporation, is for investigating and measuring the torsional vibration in components of rotating machinery such as the crankshafts of diesel engines.



Planer hysteresis loop test equipment.

New Servo-Components.—(*a*) A size 11 motor-generator available with an in-line gear-head; (*b*) A size 15 servo motor with an associated size 10 tachometer generator; (*c*) A range of size 11 synchros capable of continuous operation in ambient temperatures of + 110°C.

Servo Indicator.—Designed to provide accurate remote position indication from the signal provided by a size 11 synchro.

On/Off Controller.—This equipment makes use of a conventional moving coil instrument movement, which has a flag at the pointer tip to interrupt a light beam directed on to a photo-transistor. The output of the transistor operates a relay connected into the circuit to be controlled.

Industrial Thermometer.—This portable equipment is designed to give a rapid and accurate reading of any surface, liquid or gas temperature using a small easily handled probe connected to an indicating instrument incorporating its own battery power supply.

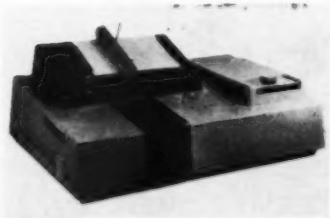
W. G. Pye & Co. Ltd. (Stand 100)

Since its introduction as the first instrument incorporating the high sensitivity argon ionization detector two years ago, the basic Pye argon chromatograph has been expanded into equipment capable of application to most of the outstanding problems in gas chromatography. A wide range of accessories and adaptors has been developed and a variety of injection systems and long columns will be exhibited.

A working demonstration will illustrate the operation of three of the many complementary units available to workers in the field. At the centre of this demonstration will be the latest version of the argon chromatograph, with the new continuously variable temperature control system (stable to 0.1°C.).

A model of the Pye process analyser will also be shown. It combines the ability to detect trace components present at less than one part per million with a completely flexible construction which enables it to be tailored to suit exactly the requirements of a particular analysis or control problem.

Other exhibits will include a range of pH meters, a rotary burette for the accurate dispensation of desired quantities of liquid, amplifiers and power units and a galvanometer pre-amplifier.



Unicam SP.200 infra-red spectrophotometer.

Racal Instruments Ltd. (Stand 16)

The chief exhibit on this stand will be the digital frequency meter SA.505 which combines the latest transistor techniques in a compact, self-contained instrument and is ideally suited to all laboratory applications in the fields of frequency, period and time interval measurement. The 10-way serializer SA.138, also in show, has been designed for direct operation with the digital frequency meter to provide permanent digital records on a solenoid operated printing machine. Other exhibits will be a computing counter controller, voltage-to-frequency converter and various types of transducers will be shown in a working exhibit on shaft speed measurement.

Royal College of Surgeons of England (Stand 145)

On this stand will be seen:

Gas Chromatograph.—Designed for the routine analysis of the gas and vapour mixtures encountered during anaesthesia. Samples of the gas mixture to be analysed are automatically injected into the chromatograph at regular intervals by means of an electro-mechanical sampling valve. The detector unit is either a thermal conductivity cell or an ionization cross-section detector. Two columns are employed, one to separate the gases, the other to separate the volatile anaesthetic agents.

Servo-operated pump.—This is a piston and cylinder pump having controllable characteristics and designed to simulate a patient's breathing. It is intended to function as a test-bed, in conjunction with suitable recording apparatus, for the calibration of volume recorders and the measurement of resistance to breathing of apparatus.

Minute volume recorder.—This instrument has been developed in conjunction with British Oxygen Gases Ltd. to record the level of respiratory exchange (in litres per minute). The output of a gas meter of conventional design is differentiated with respect to time. The differentiating device consists of a threaded rod rotated by the gas meter, and a cone driven at constant speed. A wheel is free to rotate on the rod, its rim making contact with the surface of the cone. This wheel takes up a position proportional to the minute volume of respiration.

Royston Instruments Ltd. (Stand 34)

Recording systems and tape transcribers will be featured on this stand. Examples will be shown of the Midas range of recording, playback, processing and tape transcription equipment. This year the emphasis is on the aircraft applications of Midas and the CMM range of cassette loaded recorders and associated processing equipment, which offer a complete system of economy and safety in civil and military flying.

The Midas tape transcriber has been developed to permit the direct interchange of tape between the British Standard Midas system and American Standard system. It can also be used for producing identical copies of Midas tapes from an original, with deterioration in quality.

Shackman Auto-camera MK.3.

D. Shackman & Sons (Stand 7)

A 70 mm. instrument document and oscilloscope recording camera, an Auto-camera Mk. 3 with accessories, and an oscilloscope recording camera will be featured on this stand.

The Autocamera Mk. 3 is a recording instrument designed to cover a wide field in industrial and scientific work where the rapid production of high quality 35 mm. micro-films is required. The camera is fully automatic in its operation, the exposure and film transport being effected by a single electrical impulse of approximately $\frac{1}{4}$ second duration.

The new 70 mm. camera has been introduced into the company's range of film cameras to provide a larger format area (2$\frac{1}{4}$ in. × 2$\frac{1}{4}$ in.) than that obtained with the normal 35 mm. film cameras.

Singer Instrument Co. Ltd. (Stand 55)

The Singer Instrument Co. Ltd., will be demonstrating high power, medium power and low power micromanipulators with accessories, a rational microscope lamp, laboratory burners and radiation reducers.

The high power micromanipulators are used under magnifications of from 100 to 1,000 diameters *plus*, are of rigid construction, free from backlash, with continuous variability of sensitivity, limitation of range of movement to the field of view, rapid low power centering and independent vertical control. The low power microdissectors are suitable for use under magnifications of from 1 to 200 diameters. All movements are reproductions of natural hand movements in the same direction and sense in three dimensions, and the instruments are capable of linear, angular and rotational control. The medium power micromanipulators have a very large amplitude and accuracy of movement, together with great rigidity, a rapid

movement of 25 mm. plus in the horizontal plane, an independent linear fine vertical movement of 10 mm. perpendicular to the horizontal movement, and a linear coarse vertical adjustment of 220 mm.

The rational microscope lamps, designed for Kohler illumination, have a 6 v. 8 amp. solid source filament lamp, one fixed lens for low power and two auxiliary lenses for intermediate and high power work, ensuring full illumination of the field of view of all objectives with all types of condensers in common use.

The radiation reducers to be shown are for the purpose of reducing dosage in dental x-ray machines, without impairing diagnostic value, a desirable adjustment both for the safety of the patients and operators of the machines.

Gas burners for the laboratory or work bench will be on display. These are simple and clean, with shrouded jet and leaf air control.

The Solartron Electron Group Ltd. (Stand 111)

The equipment to be exhibited includes analogue computing modules, digital converting and recording units, high speed printers, and a variety of pressure and temperature transducers among which may be mentioned a high accuracy, high reliability pressure transducer for bottom hole pressure measurement in geophysical survey; a high accuracy, absolute pressure transducer for uranium hexofluoride gas pressure measurement; a range of transmitting transducers for biological temperature and pressure measurement; a range of pressure scanning transducers; a differential pressure transducer, high line pressure working, low differential pressure; and a frequency/d.c. converter for use with variable frequency transducers.

Standard Telephones & Cables Ltd. (Stand 112)

A comprehensive array of exhibits and demonstrations will be found on this stand. Among these may be mentioned an artificial mouth for the measurement of the frequency characteristics of telephone transmitters, an electronic spectro analyser, infra-red optical filter, various types of oscillator, travelling wave tubes, transistors, transmission testing equipment and capacitors. Solid tantalium capacitors, recently developed, are to be shown. These have many advantages in the fact that they can be hermetically sealed; this has not been possible with other types of electrolytic capacitors, and gives capacitors with reliability of the same order as the established foil types.

Sunbury Glass Works Ltd. (Stand 88)

This company will be exhibiting glass targets which represent samples of thin glass and quartz crystals ground and polished for use in one case for Electric & Musical Industries Ltd. as part of the C.P.S. camera tube and the other for use by United Kingdom Atomic Energy Authority. These targets vary in thickness from .0008 in. to .0035 in.

Many different types and sizes of attenuator vanes in glass and ferrite will also be shown together with an end plate made of X43 glass with a central hole and a very large countersink running to a sharp edge representing part of an image intensifier as supplied by the company to the Royal College of Science to their specification.

Many examples will be shown of drilling of various size holes in glass showing in some cases only small distances between the holes in order to give an idea how far this may be done without weakening the glass structure itself.

Taylor, Taylor & Hobson (Stand 122)

The prototype of a new development that enables the surface finish of a 1 mm. diameter ball to be measured and recorded accurately, in half millionths of an inch, will be shown. It is the small ball surface measuring attachment for use with the Talysurf Model 3 surface measuring instrument.

Another prototype on view will be the new model 105 Talysurf, which will measure the surface finish inside cylinders of $\frac{1}{4}$ in. diameter to a depth of 10 in. It is a portable and relatively inexpensive instrument, suitable for a wide range of workshop and inspection applications. It provides centre line average readings with .03 in. cut off.

Two other new attachments for the Talysurf Model 3 will be included at the Exhibition:

1. The cylindrical datum attachment for dealing with radii of from 2 in. to infinity by the supply of suitable glass cylinders. This accessory is complementary to the existing radii attachment and deals with the surface finish on both convex and concave radii.

2. A limit for adapting the side acting gauge head to the Talysurf 3 gear box gives a lower magnification range—× 100 to × 5,000.

Among other exhibits on this stand will be the Varotal II television studio zoom lens, Talyrond Model II, Talyvel electronic level and the Ental professional enlarging lenses.

Techne (Cambridge) Ltd. (Stand 52)

The Sentichart, an instrument designed to detect and record changes of temperature of as little as 0.01°C. anywhere in the range from 30°C. to 180°C. on a circular chart, will be shown.

Three prototypes will also be displayed by this company. They are the gelation timer, the Universal Tempunit and a recording viscometer. This latter measures and prints the viscosity of any liquid from 0.5 centi-poises upwards. It is a 'dip type' viscometer of one inch diameter which can be lowered into any container. It is completely transistorized and has its own crystal controlled timing circuit.

The Thermal Syndicate Ltd. (Stand 44)

Spectrosil will be featured on this stand. This synthetic fused silica is being used in increasing quantities not only in apparatus where extreme purity is required but as an ideal material for optical work at high temperatures and in the ultra-violet spectrum. Because of this, manufacture of their previous optical grades OG and OH has been discontinued in favour of Spectrosil for all optical components.

Spectrosil 'B' is a good general optical material, superior to the previous OG and OH grades in homogeneity and transmission characteristics. It is recommended for general work in the ultra-violet region and for ultrasonic delay lines.

Spectrosil 'A' is a similar material but is manufactured against a strict specification for transmission characteristics, permissible refractive index variation and presence of bubbles. Examples of the forms in which these grades can be supplied will be shown.

Thermal Syndicate optical components.

H. Tinsley & Co. Ltd. (Stand 31)

The following are some of the items of equipment to be seen on this stand:

Automatic precision potentiometer.—The amplified error voltage controls pulses which operate the potentiometer dials until a balance is secured to the least count of 10 μv.

Automatic current controller.—Using cascaded galvanometer-amplifier stages with a transistor as the control element, a current of 15 mA can be stabilized to one part per million.

Standard d.c. potentiometer.—The advent of potentiometers of higher precision has necessitated the development of the standard potentiometer for their calibration. In the instrument to be shown, which has been designed in collaboration with the National Physical Laboratory, D. C. Gall has incorporated features in accordance with the finest present-day technique in the field.

Platinum resistance thermometry.—An improved version of the Smith bridge No. 3 will be shown with Barber type thermometers.

Computer galvanometer.—This instrument is particularly suitable for step computer work where the requirements are for a highly reproducible zero, fast response and good balance factor.

The Tintometer Ltd. (Stand 87)

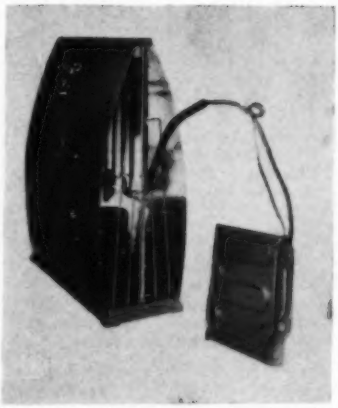
The Lovibond Schofield Tintometer which is a visual colour measuring instrument for use with liquids, solids, powders or pastes using reflected or transmitted light, will be demonstrated. This instrument enables readings made using the Lovibond series of red yellow, and blue glasses, to be converted to the x, y, z, values of the C.I.E. system and part of the exhibit will show the work done by the late Dr. R. K. Schofield to enable this conversion to be made.

As a result of this work, a simple and practical tool is readily available, whereby any colour expressed in trichromatic coefficients can at once be interpreted into the concrete terms of actual glass filters and seen by the observer as a patch of colour.

Townson & Mercer Ltd. (Stand 94)

Two developments of their standard circular low inertia Warburg apparatus will be shown by the company to meet the need for such apparatus adapted to photosynthesis techniques and for use below ambient temperatures. The latest version of their rigid glove box or isotope handling cabinet, also to be shown, incorporates an improved moulded window gasket which gives a cleaner line without loss of efficiency of the seal.

Other items on this stand will be the latest form of flexible handling cabinet, and infra-red vacuum moisture tester, the Sortationer for the electronic sorting of non-ferrous metals and alloys and, by suitable adaptation, for the sorting of titanium, a humidity cabinet fabricated in fibreglass, with a plate glass door,

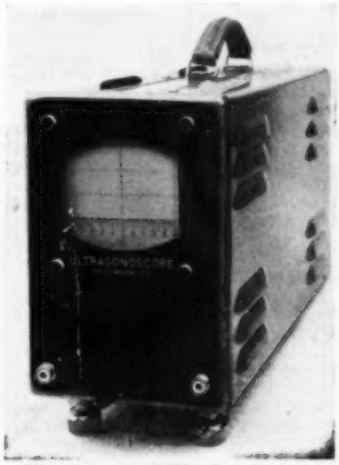


Townson & Mercer zero refrigerator unit.

and a new zero portable refrigerator unit for laboratory use. There is sufficient power to maintain a difference of 5 to 10°C. between the ambient temperature of a reasonably insulated thermostat bath up to seven gallons capacity.

20th Century Electronics Ltd. (Stand 8)

Various types of precision cathode ray tubes, photomultiplier tubes, image intensifier tubes and Geiger counter tubes will be shown on this stand, together with particle multipliers, windowless flow counters, high temperature pulse fission chambers, mean current ionization chambers, BF3 proportional counters, neutron generators, x-ray proportional counters, metal-ceramic vacuum seals, Kerr cells, fissile coated foils and a selection of stable isotopes, including Boron-10, Boron-11, Carbon-13, Carbon-12, Oxygen-18 and Nitrogen-15.



Ultrasonoscope MK.3 flaw detector.

Ultrasonoscope Co. (London) Ltd. (Stand 82)

A new addition to the range of ultrasonic flaw detectors will be shown on this stand. This general purpose model Mark II incorporates many additional facilities and improvements over the existing Mark IB portable instrument. Another addition to this range is the miniature flaw detector Mark III and in the field of manipulators, the company have developed a research immersion tank unit which allows vertical adjustment over a distance of 10 in., rotational adjustment about the vertical axis through 360°, tilt adjustment about a horizontal axis from −10° to the vertical through 200°. Glass Developments Ltd. will be showing on this stand a permanently sealed ammonia maser which has been designed as a portable, rugged and completely sealed unit.

Unicam Instruments Ltd. (Stand 107)

The Unicam SP.200, to be shown at this year's Exhibition, marks a new stage in bringing infra-red spectroscopy to the chemist. The SP.200 is designed essentially for routine analysis, but several features greatly increase the scope of the instrument. This is particularly important for those users who do not have access to a large infra-red instrument.

Spectra are presented on charts which are foolscap in size and which are ruled with scales linear in wavenumber and transmittance. The recorder is of the flat bed type and the chart carriage is drawn past the ball-point pen. The pen pressure is sufficient to produce carbon copies—very useful in cases where it is desired to attach spectra to reports and to retain a duplicate in the laboratory.

The photometer is of the double-beam null balancing type with a Nernst filament as source. The radiation enters the monochromator at a frequency of ten cycles per second. The slits are programmed to pass a level of energy which is constant over the range. The level of the programme may be varied in cases where, for example, there is strong absorption in the reference beam and the energy of the system restored to the normal level. A 60° rock-salt prism is used as dispersing element, and the radiation is finally focused on to the Golay detector. The electronics are mounted in three small chassis and a monitoring system is provided.

The SP.200 is equipped with the standard type of slide mounts and will accept the majority of cells in use with nfra-red apparatus, and a very wide range is available.

A new model of the SP.700 recording spectrophotometer will also be shown.

United Kingdom Atomic Energy Authority (Stand 39)

Equipment to be shown on this stand is not manufactured for sale and enquiries about their supply or design should be addressed to the Director of Public Relations, U.K. Atomic Energy

Authority, 11 Charles II Street, London, S.W.1.

Atomic Weapons Research Establishment, Aldermaston.—Data handling equipment which has been developed to speed up assessment of film records and to present the data obtained in such a form as to be suitable for direct input to a computer; digitized film assessor enabling the information obtained to be punched directly on to cards for computing; a digitized microdensitometer; and a digitized microscope used for measuring the length and direction of particle tracks in emulsion.

Atomic Energy Establishment, Winfrith, Dorset.—A magnetic flow-measuring instrument for non-conducting fluids, slurries and dusts.

Atomic Energy Research Establishment, Harwell.—The resonance absorption of gamma rays by the Mossbauer effect will be demonstrated.

Research and Development Branch, Development and Engineering Group, Capenhurst, Cheshire.—A non-dispersive infra-red gas analyser; a scanning Fabry-Perot spectrometer; and an acidity meter for radioactive plant.

Chemical Services Branch, Production Group, Capenhurst.—An automatic gas chromatographic analyser for volatile inorganic fluorides.

Venner Electronics Ltd. (Stand 19)

The company will be showing a range of new transistorized instruments. Apart from a comprehensive data logger for monitoring voltage, frequency, time and resistance, they are featuring their new digital volt ohm meter. This fully transistorized, four digit instrument, measures d.c. and a.c. voltages from 1 mV to .1 kV and resistance to 1.1 MΩ. The results are displayed by new type in-line projection indicators. A further addition to the 1961 range is a six digit frequency meter, capable of measuring frequency to 1 Mc/s, and time in units of 1 μsec. The display is by new type in-line projection indicators.

For permanent recording the company will be showing their reperforator control unit for five-hole tape, and their high speed printer.

Venner Accumulators Ltd. will exhibit their latest developments in a range of lightweight accumulators of the primary activated type.

W. Vinten Ltd. (Stand 6)

The cameras to be shown on this stand will be the 16 mm. scientific camera Mark I and II which, this year, have had various extra items of equipment added as accessories, 16 mm. high speed cameras one of which is capable of operating up to a maximum of 250 pictures per second, and a 35 mm. instrumentation camera which is fitted with 200 ft. film magazine and single detachable lens. A viewfinding system is provided which enables the operator to view the subject through the lens while setting up the camera in position. It is capable of various speeds by the attachment of five different drive motors giving a range of frequencies from single shot to 48 pictures per second.

VISIT THE U.T.P. STAND No. 78

Enquiries concerning their publications in the instrument and research field will be welcomed by United Trade Press, Ltd., at Stand No. 78. Among the journals and publications to be displayed will be: *Laboratory Practice, Instrument Practice, Automation and Automatic Equipment News, Radio & Electronic Components,* **'Course in Industrial Instrument Technology,' 'The Instrument Manual', 'Electrical Measuring Instrument Practice,' 'Laboratory Control of Dairy Plant,' and 'The Industrial Application of pH Measurement and Control'.**

W. Watson & Sons Ltd. (Stand 101)

The company will exhibit a new interference microscope objective for the examination of specimens by reflect light at a magnification of approximately × 100. This interference objective has been designed for use with Watson microscopes but can be used with instruments of most other manufacturers. The lau-Sabattier photographic technique can be used to produce photographs showing fine lines representing contours of equal tensity on the original fringe pattern.

The Watson cystocope, which is designed to allow a urologist the facility of rapid photography in colour for the recording of pathological conditions, will also be shown for the first time.

The Barnet ventilator which can be used to supply anaesthetic gases from standard theatre apparatus and also air or gases from pipe lines, cylinders, pumps, and compressors is also shown in its latest form.

A full range of microscopes for application in science and industry complete with the latest accessories will be exhibited on this stand.

Wray (Optical Works) Ltd. (Stand 13)

Among the exhibits on this stand will be the 6 in. f/4.5 wide angle survey lens. The lens is fitted as standard to the Ministry of Supply FX 105 aerial survey camera.

Designed for the inspection and manufacture of very small assemblies, the binocular magnifier also to be shown gives magnification of 10× linear with a working clearance of 7 in. between the object glass and the focused image. The object glass has a 30 mm. clear aperture with exceptional light gathering however, enabling the instrument to be used without supplementary lighting. A circular field of 22 mm. is viewed, with the image seen the correct way up and the correct way round. Available also with a magnification of 20×. A graticule can be fitted for accurate measuring if required.

Visitors can also see the Prismscope telescope with interchangeable eyepiece of 20× and 30×. A unique system of focusing is incorporated in the instrument. In place of the rotating eyepiece, a rigid eyepiece is fitted and provision for focusing is provided by a moving platform, complete with prism, by a multi-thread screw acting through a water proof gland.

CATALOGUES, BROCHURES & LEAFLETS

Received from Manufacturers

B.D.H. Leaflets.—New entries in the catalogue of British Drug Houses Ltd., of Poole, Dorset, are listed in the October 1960 issue of their monthly leaflet. These are as follows: *Organic and Inorganic Chemicals.*—Dioxan; tetrahydroxy-*p*-benzoquinone disodium salt; 2-thenoyl-trifluoro-acetone. *Amino Acids.*—L-3-(3:4-dihydroxy-phenyl)-alanine. Other notes are concerned with assay methods for serum enzymes and the Milk (Special Designation) Regulations, 1960.

Evershed News.—The October issue of *Evershed News* published by Evershed & Vignoles Ltd., Acton Lane Works, Chiswick, London, W.4, is the first to be presented in its new format. This, in conjunction with the new layout, has resulted in a first-class house journal. This current issue contains articles on the automatic control of the concentration of mixtures of liquids, the metric version of the precise tank gauge, earth loop testing, further developments on the quick response recorder, and accurate measurement of torque in ball bearings.

Volumetric and Lampblown Glassware.—Griffin & George Ltd., of Ealing Road, Alperton, Wembley, Middlesex, have now completed distribution of their current price list of volumetric and lampblown glassware, and all those customers in educational, industrial and Research Laboratories who are on the Group's mailing list should have received their copy. The catalogue comprises some 60 pages, profusely illustrated with a wide range of 'Griffin' and 'E-Mil' glassware, including burettes flasks, pipettes, butyrometers, soxhlet extractors and viscometers. Copies are freely available from any of the Group's Regional Offices.

News from the British Association of Chemists

OBITUARY

It is with very great regret that we have to record the decease of Mr. Charles Samuel Garland who died on December 6, 1960, aged 73. He was President of the B.A.C. in 1925-26 and was awarded the Association's Hinchley Medal in 1946. He was Chairman of Council and a member of the Executive Committee for a number of years.

Mr. Garland took an honours degree and the Associateship at the Royal College of Science and passed the examination of the (then) Institute of Chemistry in 1910. After teaching at the Imperial College, where he made a special study of the rare earths, he became Works Manager and in 1912, a Director, of the Volker Lighting Corporation, one of the largest manufacturers of gas mantles in Great Britain. In 1916 he also became Managing Director of The Clay Ring Co. and later of W. L. Ward & Co. In 1916 he became a Director of Thorium Ltd. and in association with the late Edmund White established the first factory in the British Empire for the extraction from monazite of thorium, cerium didymium and other rare earths. In 1920, when Nobel Industries combined the principal manufacturers of thorium and cerium salts, ramie yarn and gas mantles, he became Managing Director of the Group ('Lighting Trades'). He resigned from this position on being elected Member of Parliament for S. Islington in 1922.

In 1923 he became interested in the new principle of filtration arising from the late Dr. Hele Shaw's researches on stream line flow and formed the Stream Line Filter Co. of which he was, until a few years ago, Chairman and Managing Director. With the co-operation of I.C.I. and the foremost German manufacturers of electrical insulators, Mr. Garland built at Stourport a factory which remained at the forefront of ceramic progress and whose products were essential for radar and high frequency work during the last war. As Chairman of the Metafiltration Co. Ltd. he provided much of the mobile water purification plant for our forces in the Middle and Far East; and of Caston and Co. who equipped our Coastal Forces boats.

Mr. Garland was a founder and later Chairman of The Chemical Engineering Group of the Society of Chemical Industry and as Chairman of the London Section organized the first Congress of Chemists in London in 1925. He was also one of the founders of the Institution of Chemical Engineers, its first Hon. Registrar, and President from 1941 to 1943. He was awarded the Institution's Osborne Reynolds Medal in 1940.

In 1923 he became representative of the Crown on the Governing Body of the Imperial College, in 1924 a Governor of the City and Guilds Engineering College, and Vice-President of the National Union of Manufacturers, becoming President in 1957 and Chairman of its Advisory Service (N.U.M.A.S.) in 1959.

Mr. Garland's services to the B.A.C., from its earliest years on, have been of immense value, and in spite of his widespread activities he has always found time to help and advise whenever the occasion arose. He was one of its Trustees for many years and the B.A.C. has indeed suffered a very great loss on his passing.

It was perhaps charactistic of his independence of thought that while a Conservative Member of Parliament he strongly supported the registration of the B.A.C. as a Trade Union so that it could give effective support to its members.

Some Impressions of the U.S.A.

Readers of this page will recall that the Hon. Editor of *The British Chemist* recently reported on a visit which he had paid to Russia. He has now returned from a visit to the U.S.A., during which he travelled from New York to California, and writes as follows:

A visit to the United States for the first time does not quite have the same novelty as a visit to the U.S.S.R. Our apparent knowledge of the people of the U.S.A. seems much greater, and superficially our ways of life may be similar. A short visit however clearly indicates the enormous differences between Great Britain and the U.S.A.—one might almost say between Europe and the U.S.A.

Firstly the difference in size of the United States compared with Great Britain must be remembered. It is 2,600 miles from New York to San Francisco or Los Angeles. North—South distances are almost as great. Secondly the country, except for the States west of the Rockies, has a savage climate—extremely hot in the summer, and most of it bitterly cold in the winter in spite of the fact that the whole country is south of the 49th parallel. New York is on the same latitude approximately as Rome. Thirdly, although a number of accidents of history have made the U.S.A. the richest country on earth, it is still relatively sparsely populated, population density being only a fraction of that of India, although this may seem strange to the visitor to Manhattan. 'Go West' is still a possibility for the restless or enterprising young man.

Chemists and Salaries

Salaries are about double those in this country. The cost of living in the U.S.A. varies, but a fair figure is about one and a half to one and three quarters that in Great Britain. Standards of living are therefore somewhat higher. This is true in all walks of life, and wages of manual workers are often above three times those prevailing here. It is remarkable, therefore, that the theoretical socialist ideal of 'To each according to his needs' has neared fruition far more closely in the U.S.A. than in the U.S.S.R.! It must be remembered, however, that there is acute unemployment in certain areas, e.g. the coal-mining areas of Pennsylvania, and that conditions in the South are probably very different.

To return to the laboratory, it seemed that almost the entire work in industrial laboratories is done by graduate staff, assisted by a few technicians. The large numbers of young assistants, spending one day per week on part-time study, do not seem to exist, as far as I could ascertain. Most young men would be able to afford full time education at University. It is surprising that two weeks holiday only is the general rule. Hours are much the same as in this country, although with a tendency for an earlier start and finish than in Southern England.

All correspondence and enquiries concerning this Association should be addressed to G. R. Langdale, Esq., The British Association of Chemists, Nomination Dept., 14 Harley Street, London, W.1. Tel.: Museum 7021.

Section Programmes

Birmingham and West Midlands

April 7, 1961. Schools Meeting (details to be announced later).

Liverpool

The 44th Annual Meeting of the Section will be held on Wednesday, January 25, 1961 (time and place to be announced later).

London

The 43rd Annual Meeting of the Section will be held on Wednesday, February 15, 1961 at 6.30 p.m. at The Wellcome Institute, 183 Euston Road, N.W.1. After the meeting there will be a Lecture by Mr. F. Jowett, M.Sc. on 'Chemistry in the Footwear Industry'.

The East London and Essex Branch of the Section is holding its first Annual Social Meeting on the evening of Monday, January 9, 1961 at 'The Spotted Dog', Barking, Essex.

LABORATORY EQUIPMENT & APPLIANCES

The Technicon AutoAnalyzer

Development of a two-speed proportioning pump and an automatic sampler of greater capacity has extended the scope of laboratory applications for the AutoAnalyzer.

The Technicon AutoAnalyzer, available in laboratory and plant models, is a continuous flow system that automates each step of a chemical analysis now performed manually, including measuring, mixing, purifying, processing, comparing and recording. Because sample size, time and temperature remain constant, reproducible results can be obtained down to parts per thousand million with a precision of ± 1 per cent. Since the AutoAnalyzer checks the sample to be analysed against a continuous stream of standard sample, the process is self-correcting.

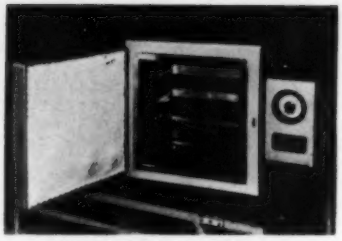
Until now automation of laboratory procedures was practical only for large numbers of repetitive tests as each test series required long set-up time. With the advent of the AutoAnalyzer's two-speed proportioning pump, set-up time between test series is reduced to as little as one minute.

The two-speed proportioning pump provides the operator with a choice of standard-speed or high-speed flow equal to four and a half times standard speed. This makes it practical to run as many as 10 or 12 different analyses daily on the same machine with minimum changeover. This feature is of great advantage to small laboratories which run a great variety of tests for a small number of samples of each.

The new sampler holds 200 test tubes of 30 ml. volume on an automatic, self-revolving rack, making it possible to test-run the AutoAnalyzer for more than 30 hours with one rack-loading. The machine can be set at the end of a work day and will continue to operate overnight, unattended, providing 200 analytic results the following morning. The sampler is equipped with two timers—one controlling a selective aspiration period, the other the total cycle-time. The system is cleansed during the difference between the two timer settings.

Techniques developed for low-level analyses, hitherto limited to monitoring applications in view of large sample volume required, can now be employed in laboratory work with the AutoAnalyzer.

(Manufacturers: Technicon Instruments Co. Ltd., 26 Warwick Road, Earl's Court, London, S.W.5).



Isopad stainless steel oven.

High Temperature Laboratory Oven

The oven illustrated was designed to meet the special requirements for a high temperature laboratory size oven. The inner stainless steel casing measures 40 × 40 × 30 cm. (approximately 15¾ × 15¾ × 11¾ in.) is backed by 3 in. of thermal lagging, and the outer casing is stove enamelled mild steel.

Three stainless steel trays are fitted and the oven temperature is automatically controlled by a mercury-in-steel contact thermometer calibrated 0-800°C. Thanks to the high thermal efficiency, a loading of 1,800 watts is sufficient for the operating temperature of up to 500°C. (930°F.) required in this instance.

Ovens of this nature are also made in larger dimensions as well as in the special design suitable for use in flameproof areas Group II and III: in that case, the heating elements are metal sheathed and mineral insulated—terminating in flameproof glands and flameproof terminal boxes. The element temperature must be kept below the spontaneous ignition temperature of explosive gases or liquids present, for which purpose a range of controls in flameproof housings or automatic intrinsically safe controls are available.

(Manufacturers: Isopad Ltd., Barnet By-Pass, Boreham Wood, Herts.).

Rotational Viscometer

The Rheomat 15 rotational viscometer, manufactured by Contraves A. G. of Zurich, is now available in this country.

Instead of the usual single-point measurement obtained with many types of viscometers (which are often misleading for plastic and thixotropic materials), the rotational viscometer 'Rheomat 15' yields data of the flow properties of Newtonian, plastic, thixotropic, dilatant and pseudoplastic materials from which consistency curves characteristic of the type of flow of the material can be plotted. This information frequently aids in the interpretation of the properties of these materials in their various applications.

With the 'Rheomat 15' it is possible to evaluate the rheological properties of a wide variety of materials such as viscous liquids, resins, pigment dispersions, emulsions, paints, printing inks, adhesives, coating compositions, starch pastes, food and pharmaceutical products, and many others. The viscosity, yield value and thixotropic behaviours of these materials can be measured over a wide range of rates of shear and shearing stresses.

(Sole U.K. Agents: Short & Mason Ltd., Aneroid Works, 280 Wood Street, Walthamstow, London, E.17).

Graphispot Recorder

The Graphispot recorder, manufactured by S.E.F.R.A.M. of Paris, is a light spot follower for the laboratory recording of small electrical or mechanical variations at frequencies up to 2 c/s. (See below.)

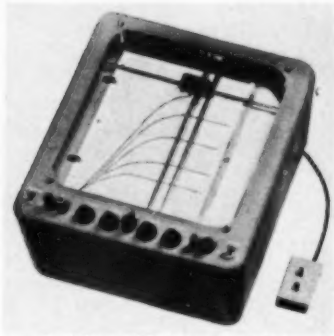
For electrical measurements it incorporates the Schlumberger anti-vibration and shockproof mirror galvanometer, which obviates the needs for amplifiers, even when operating direct from thermocouples.

In the GR 4 VAD model the galvanometer is essentially voltage sensitive (for thermocouples, resistance bridges, strain gauge measurements, etc.) and in the GR 2 VAD model the galvanometer is essentially current sensitive (for photocells, electrometer tubes, ionization gauges, etc.).

For mechanical movements it is only necessary to attach a small mirror to the moving element, and movements down to 1 micron can be recorded.

Because of its wide versatility as a recording device and its simplicity and reliability of operation, these units are finding wide application in laboratory use.

(Available from: Dobbie McInnes (Electronics) Ltd., 55 Kelvin Avenue, Glasgow, SW.2.).



A New Point-plotting X-Y Recorder

The new Houston Model HR-93 X-Y recorder incorporates an improved electric pen lift mechanism of simple and robust design allowing point plotting and family curve tracing. The pen lifter can be operated either manually using the push button control box or it can be designed into the test circuitry for automatic operation. The recorder can also be used for conventional full line curve tracing. Chart changing is also facilitated by means of a 'Load-operate' switch which automatically lifts the pen and removes it away from the chart area; after loading the fresh chart the pen is held up so that no trace appears when the pen carriage returns to the original position.

The recorder is simple in both operation and construction using standard 8½ in. × 11 in. graph paper located on a flat bed. Each axis contains its own power supply, attenuator and zero control and is independent, both mechanically and electrically of the other. Amplifiers are interchangeable in 10 mV/in. and 1 mV/in. sensitivity for either or both axes. The accuracy is within ± 0·5 per cent with 7·5 in./sec. pen speed for both axes. Snap-on pen construction permits rapid interchange for various colour traces. The 'straight-through' pen design facilitates quick cleaning and allows the use of washable fountain pen inks.

(Available from: Scientific Furnishings Ltd., Poynton, Cheshire).

A New 'Power Pack' for General Experimental Work

A stabilized power supply unit is now available, the design of which has been thoroughly tested over an extensive period of time and stability on all types of load, particularly capacitive loads, is ensured. All components have been carefully chosen for their reliability under extreme conditions and they are all conservatively rated.

The functions of smoothing are carried out by high quality paper condensers and no electrolytic condensers are incorporated throughout the circuit.

A comprehensive range of voltages can be supplied and all d.c. outputs are fully stabilized against supply and load variations. The range includes d.c. outputs from 0 to 500 V, a fixed negative supply of −250 V and a variable negative supply of 0 to −250 V, all containing less than 0·003 V ripple. In addition two separate a.c. supplies, each of 6·3 V at 5 A are provided.

(Manufacturers: W. G. Pye & Co. Ltd., Granta Works, P.O. Box 60, Cambridge)

NEWS

General

Research and Development

A new colour film entitled 'Research and Development' has been made by the United Kingdom Atomic Energy Authority. It describes the main lines of research at the laboratories of the U.K.A.E.A.'s Research and Development Group at Culcheth, Springfields, Windscale and Capenhurst, and outlines the Authority's work on fuel elements for the nuclear power stations now being built for the Electricity Generating Boards and for the prototypes of new reactors.

Hospital Equipment and Medical Services

The 3rd International Hospital Equipment and Medical Services Exhibition will be held in the Grand Hall, Olympia, London, from May 15 to 20, 1961, covering a total area of well over 100,000 sq. ft.

In 1959 it was decided to made this Exhibition a biennial event and, there is no doubt that, after a space of two years, the third presentation will break all precedent in quality and numbers of exhibits and attendance. In 1958 there were 151 exhibitors and an estimated attendance of 21,000; in 1959, 176 exhibitors and 25,000 visitors, including official representatives from nearly 70 different countries.

This Exhibition is also planned to run concurrently with conferences and lectures arranged by many important organizations concerned with hospital government and services. During the six-day showing, conferences will be held on the premises by the Institute of Hospital Administrators (Annual General Meeting and three-day Conference); the Institution of Hospital Engineers (Annual General Meeting and three-day Conference); the National Association of Hospital Supplies Officers; the Society of Hospital Laundry Managers; the Chartered Society of Physiotherapists; the Guild of Public Pharmacists; and the Hospital Caterers' Association.

A Special Features Section, which has attracted great interest on both previous occasions, will again form an integral part of the Exhibition. This is designed to illustrate not only some of the greatest medical achievements of our time, but also events and equipment of historical interest. Plans for this section include a Ministry of Health Architectural Exhibit, designed by the Central Office of Information and the Royal Institute of British Architects; a fully-automatic canteen-cafeteria, by the British Automatic Company Ltd.; a display of some of the most modern medical equipment, details of which are to be announced later; historical instruments; and, it is hoped, a blood bank.

Drawing Office Equipment and Materials Exhibition

The first national Drawing Office Equipment and Materials Exhibition in the UK is to be held in the Royal Horticultural Society's New Hall, Westminster, from June 5-8, 1961, and is organized by UTP Exhibitions Ltd.

The exhibition is being held to give facilities to manufacturers of drawing office equipment and materials to show their specialized equipment and the latest developments in this industry. Virtually every requirement for the drawing office in all branches of industry will be on display during the four days of the exhibition.

Both British and overseas equipment will be on show, and it is anticipated that this first Drawing Office Equipment and Materials Exhibition will be so well supported that a larger hall will be necessary when it is held again in 1963.

Publications

Titration in Non-aqueous Solvents

The third edition of this book by A. H. Beckett and E. H. Tinley has now been published by British Drug Houses of Poole, Dorset. It deals with theoretical considerations, solvents, titration of basic substances, titration of acidic substances, miscellaneous applications, differentiating titrations, titration of Lewis acids, high frequency titrations, applications to synthetic organic chemistry, applications of chelating agents, and redox titrations.

The booklet also includes a valuable selection of references.

MEETINGS FOR THE MONTH

Mid-January to Mid-February

January 10

The Society for Analytical Chemistry (Midlands Section). At the Technical College, Wolverhampton. 7 p.m. 'Polarography for Trace Analysis', by Mrs. B. Lamb, B.Sc.

January 11

The Society of Instrument Technology (Data Processing Section, London). Visit to the British Iron and Steel Research Association, followed by 'The Tallimarker — An Information Handling Scheme for Processing Lines', by W. L. Marks, M.Sc., and D. J. Mayes.

January 12

The Society of Instrument Technology (Liverpool Section). At M.A.N.W.E.B. Industrial Development Centre, Liverpool. 7 p.m. 'Load Cells', by J. M. Hook.

The Society for Analytical Chemistry (Western Section). At Bristol. Annual General Meeting followed by a Joint Meeting with the Bristol and District Section of the R.I.C. on 'Polarography'.

January 19

The Society of Instrument Technology (Bristol Section). At the University of Bristol, Physics Department, The Royal Fort, Bristol, 8. 7.30 p.m. 'Some Aspects of Physical Research on Tobacco', by P. S. H. Boyce, B.Sc.

The Society of Instrument Technology (East Midland Section). At Nottingham & District Technical College, Burton Street, Nottingham. 'The Electrical Synthesis of Music', by A. Douglas, M.I.R.E., M.Amer.I.E.E.

The Society of Instrument Technology (Newcastle Section). In the Conference Room, Roadway House, Oxford Street, Newcastle-upon-Tyne, 1. 7 p.m. 'Recent Advances in Photo-Electronic Instruments', by H. Loebl, B.Sc., A.M.I.Mech.E.

January 24

The Institution of Chemical Engineers (North Western Branch). At Birkenhead Technical College. 7.30 p.m. 'Experimentation and Reactor Design in Process Research and Development', by W. Waddington and W. D. Betts.

The Society of Instrument Technology (Tees-Side Section). At the Cleveland Scientific and Technical Institute, Corporation Road, Middlesbrough. 7.30 p.m. 'The Experimental Investigation of Space', by Dr. P. J. Bowen, B.Sc.(Eng.), Ph.D.

January 25

The Society of Instrument Technology (South Wales Section). At the Welsh College of Advanced Technology, Cardiff. 6.45 p.m. 'The Fire and Explosion Hazard of Intrinsically Safe Instrumentation', by S. J. Emerson, M.Eng., B.Sc., M.I.E.E.

January 26

The Society of Instrument Technology (Chester Section). In the Lecture Theatre, Administration Building, The Associated Ethyl Company, Oil Sites Road, Ellesmere Post, Wirral. 7 p.m. 'Satellite Instrumentation', by R. C. Jennison, B.Sc., Ph.D., F.R.A.S.

January 27

The Society for Analytical Chemistry (Scottish Section). In Glasgow. Annual General Meeting followed by an Ordinary Meeting on 'Chemical Research in the Electricity Supply Industry', by J. M. Ward, B.Sc., F.Inst.Pet., F.R.I.C.

January 28

The Society of Instrument Technology (Cheltenham Section). Visit to the Berkeley Power Station.

The Society for Analytical Chemistry (North of England Section). At the Nag's Head Hotel, Lloyd Street, Manchester. 2.15 p.m. Annual General Meeting followed by the chairman's address by J. R. Edisbury, D.Sc., Ph.D.

February 1

The Society for Analytical Chemistry (Society Meeting). At the Meeting Room of the Chemical Society, Burlington House, London, W.1. 7 p.m. Meeting on 'X-Ray Fluorescence'.

February 3

The Society of Instrument Technology (Fawley Section). In the Administration Building, Esso Refinery, Fawley. 5.30 p.m. 'Instrumentation in Radio Astronomy, by Dr. H. P. Palmer.

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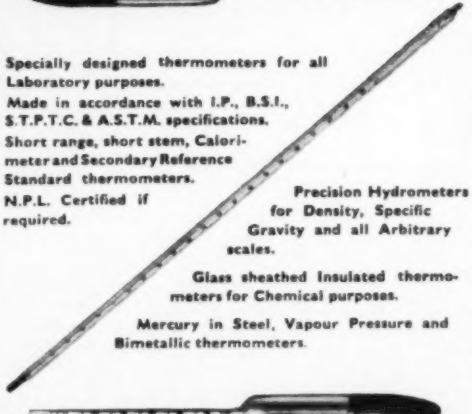

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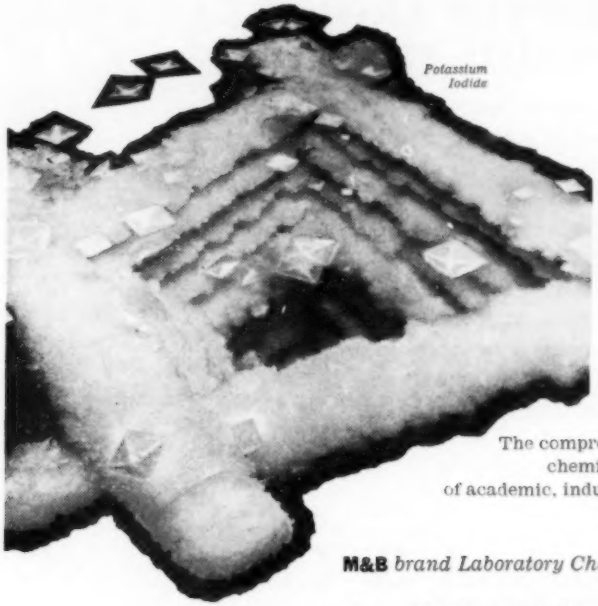

Interesting Facets

of chemical manufacture include the occurrence, from time to time, of unusual crystal "build-ups". This photograph was taken in one of the many May & Baker laboratories producing chemicals for use throughout the world.

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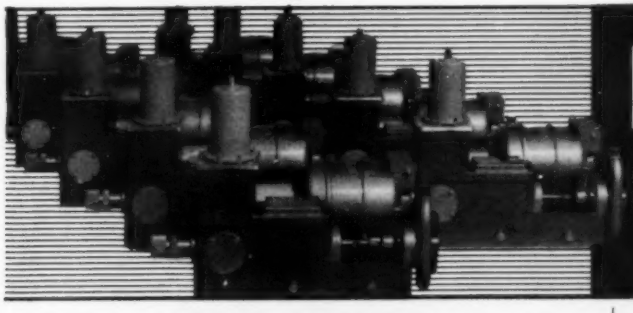

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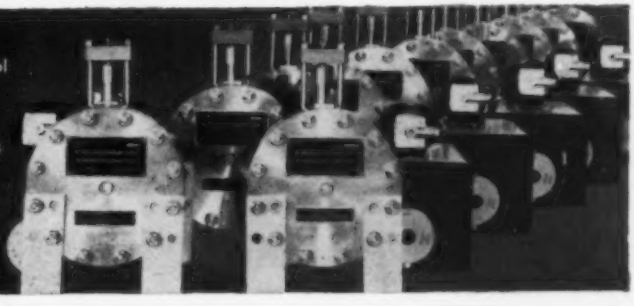

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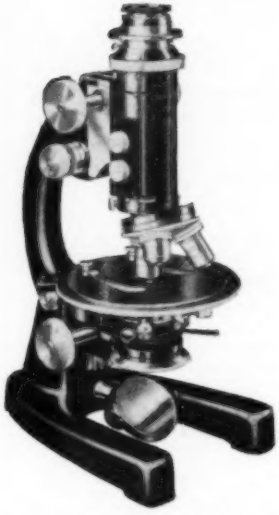

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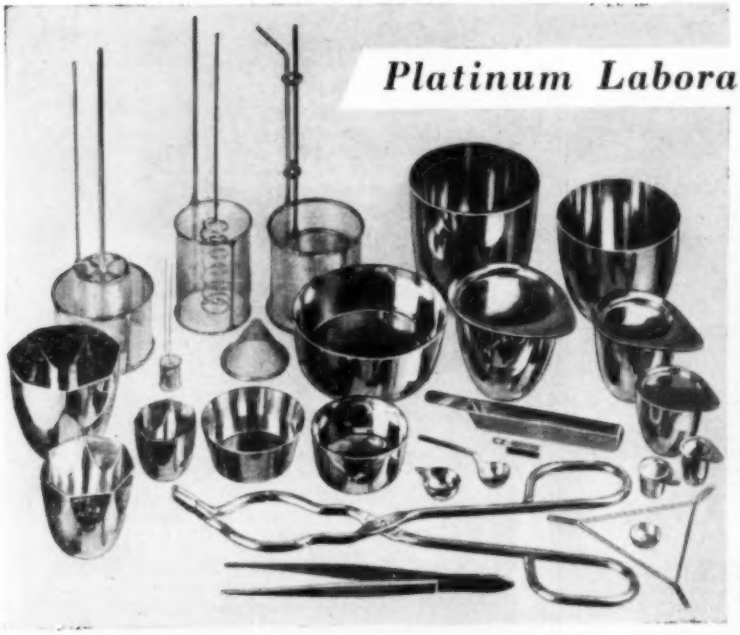

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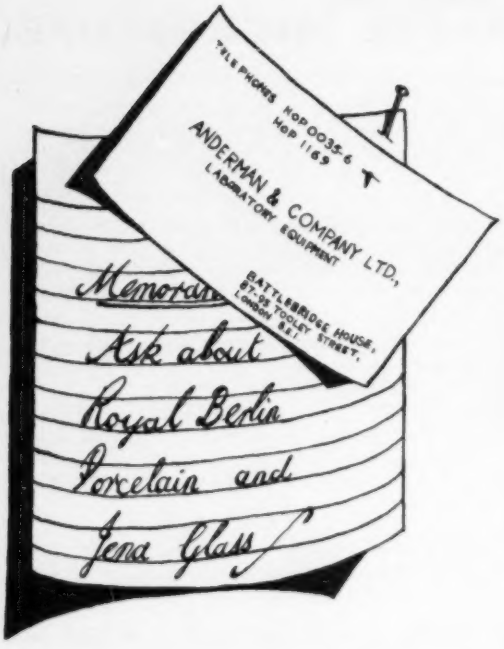

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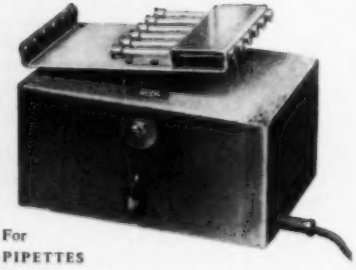

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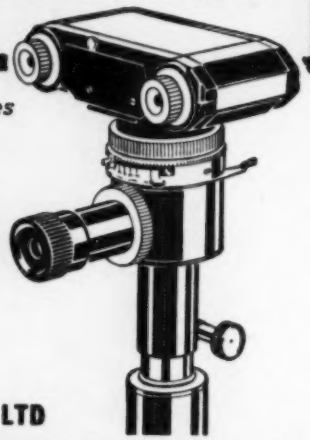

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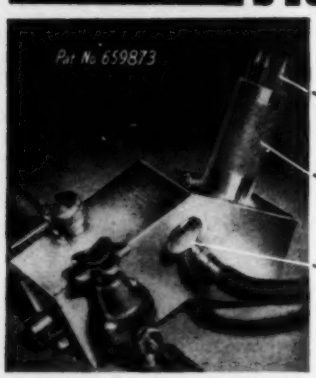

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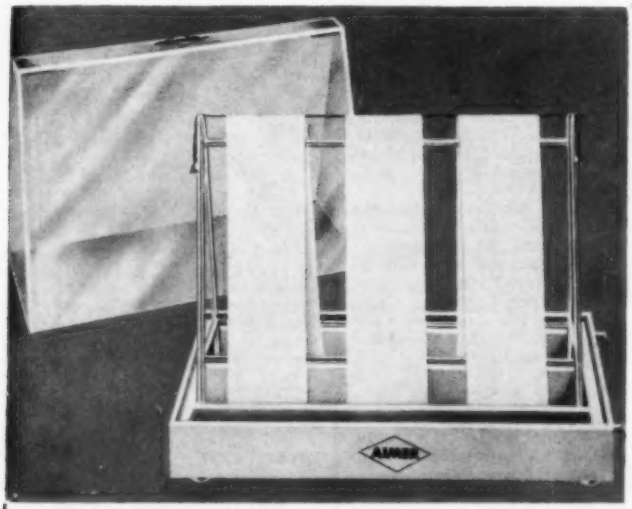

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continued from page 64

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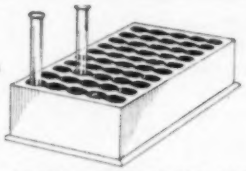

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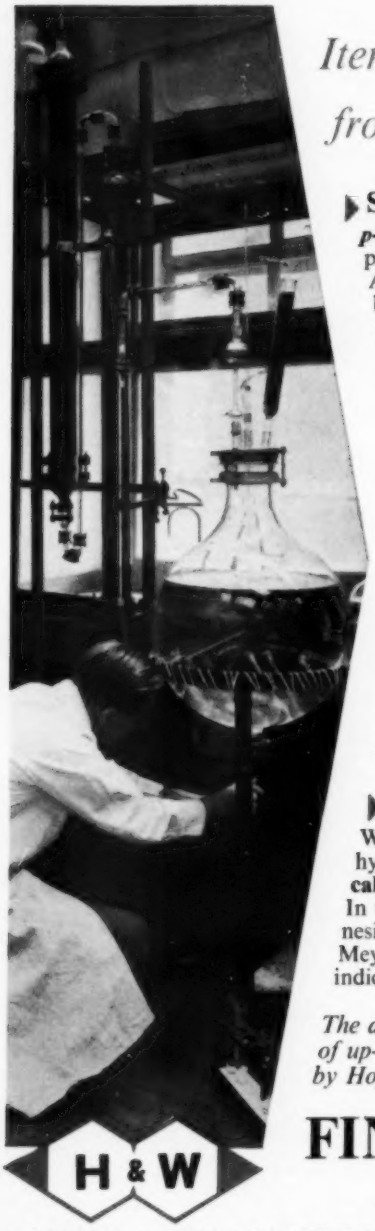

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microbiological reagents and media

for

TISSUE CULTURE

and

VIRUS PROPAGATION

These reagents are prepared and standardized to preserve unaltered the properties of the original material and include those commonly employed for the slide, roller tube and flask culture techniques for propagation and study of tissue cells and viruses *in vitro*.

REAGENTS OF ANIMAL ORIGIN — Desiccated and Liquid

Plasma, Sera and Serous Fluids
Embryos and Embryo Extracts
Ultrafiltrates

REAGENTS, CHEMICALLY DEFINED — Dilute and Concentrate

Synthetic Media — Eagle-HeLa, Eagle L, Scherer, 199, 703 and all formulas

Balanced Salt Solutions — Earle, Gey, Hanks, Osgood, Simms, Tyrode and all formulas

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TAS/DO.2